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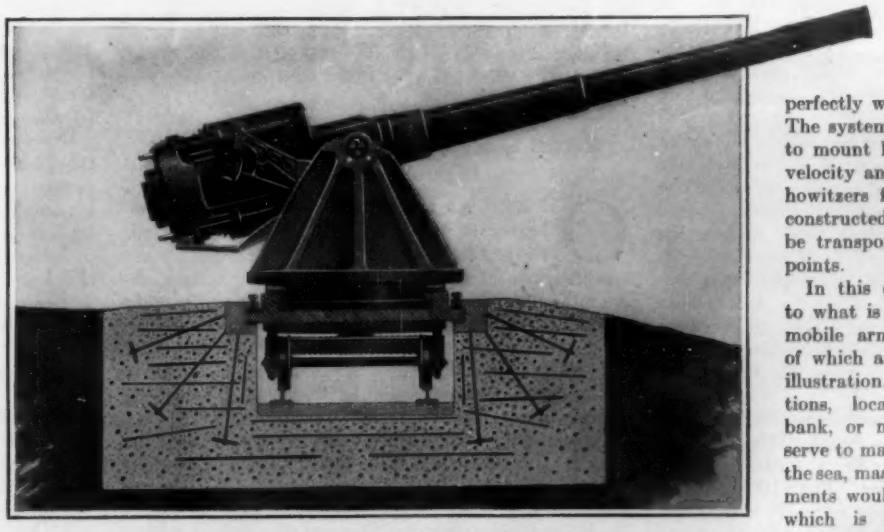
Proposed system of coastline defense, employing fixed concrete emplacements and mobile heavy artillery mounted on cars and capable of rapid concentration at threatened points

A System of Mobile Coast Defense

IT is unfortunate that the elaborate system of forts which protects the harbors of the United States, should have been called "coast defenses." They are not far-flung coast defenses, but rather localized harbor defenses. As we showed in a recent article, our coast fortifications were designed: First, to protect the coast cities, the anchorages, naval bases, factories and other utilities from bombardment; second, to prevent the occupation by an enemy of our harbors as bases for invasion, for which they would be well suited because of the railroad lines which radiate from these harbors to the wealthiest parts of the country; third, to give safe harbor to our own fleet, should it be defeated, so as to enable it to refit for further operations; fourth, to cover reasonable water areas to the seaward of our harbors, in which waters our own fleet, on emerging, could take up battle formation before coming under destructive fire by a blockading enemy fleet.

Now, our present harbor fortifications fulfill these conditions fairly well, the main drawback being that the range of the guns is not as great as is desirable in view of the extreme ranges attained by modern naval artillery. But these harbor fortifications extend their protection only to that section of the coastline which is covered by the range of their guns, or say, a matter of 15,000 to 20,000 yards of coastline adjoining the fortifications. So far as these heavy guns are concerned, the stretches of coastline between fortified harbors, sometimes extending for hundreds of miles, are devoid of any defense. Consequently, it would be possible to land large enemy forces at certain favorable locations on the long stretches of coastline between our coast fortifications; for we do not possess any heavy mobile artillery of sufficient range and power to prevent the ships of the enemy from coming in close enough to cover the landing of their forces by sweeping the adjacent country with heavy shell-fire.

Fortunately, the coastline of the United States is paralleled by excellent railway systems, which would make it possible to transport mobile artillery rapidly to any point at which the enemy threatened to make a landing. Of course, it will be understood that not all of the present undefended coastline would be favorable for landing troops in large numbers; but there are certain stretches of beach which would be suitable for such an enterprise, and these are perfectly well known to our military men. The system of defense proposed would be to mount heavy guns, both rifles of high velocity and great range and mortars and howitzers for high-angle fire, on specially constructed cars, upon which they could be transported rapidly to the threatened points.



Cross-section of a concrete platform showing the base of the gun mounting locked in position and the gun ready for firing

In this connection, we draw attention to what is known as the Luellen-Dawson mobile armament system, the principles of which are shown in the accompanying illustration. At certain concealed positions, located preferably behind some bank, or natural elevation, which would serve to mask them from observation from the sea, massive, armored concrete emplacements would be built, the construction of which is shown in our accompanying illustrations.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs

The U-Boat Menace

THE announcement of the number of merchant ships sunk by submarines during the past week shows a great increase, equal, indeed, to that of the first week of February. It is the most serious war news that has reached us from Europe for many weeks, and exceeds in importance even the great drives which are being made by the French and English on the Western front. We say this advisedly; for if the Franko-British offensive is maintained at the present rate it may drive the Germans back to their own frontier within the next two years; but if the rate of increase in the shipping losses shown during the past week should be maintained, Germany will be in a fair way to make good within a few months its threat of neutralizing the allied effort by choking off supplies from overseas.

This sudden and alarming increase in the number of sinkings comes as a verification of our word of warning two or three weeks ago that it was probable Germany had concentrated the whole of her ship and engine building facilities upon the construction of submarines, and that, if so, it was quite possible for her to set afloat five hundred submarines in the next six months, and a thousand within the year.

We repeat again, and it cannot be too often reiterated, that the submarine war is by far the most vital question of a naval and military character now before the United States. We are one of the Allies, and if we wish to exert our strength immediately, and in the direction in which it will tell with greatest effect, we should bend every energy at once to the defeat of the German attempt to sweep all shipping from the high-seas. We should at once concentrate our naval shipbuilding forces upon the construction of those types of vessel which can be most quickly built, equipped, manned and sent to the scene of the submarine attack. The question is neither involved nor obscure, and it takes only clear vision and common sense to realize the truth of the above statement. Therefore, we do not hesitate to affirm with regard to our present program for building battleships and battle-cruisers, that wherever the construction of the ships of that program would interfere in the least with the construction of destroyers, torpedo boats, chasers, or food and munition carrying ships, such construction work should be stopped at once and the anti-submarine program be given absolute precedence.

It is stated that the Secretary of the Navy is disposed to take this view of the case, and we know that there is a growing disposition in Congress to regard the problem from the same angle. We do not, of course, suggest that the construction of our new capital ships should be postponed necessarily until the end of the war. It would be sufficient to hold it up until we, in common with our allies, have got the submarine warfare absolutely under control. As soon as that point has been reached, it will be logical to proceed with capital ship construction.

There is another consideration favorable to delay on the capital ships which is of no little importance. We refer to the fact that every naval engagement of the war brings its own lessons as to armor, armament, internal hull protection against torpedoes, etc. Should the German fleet come out in strength for a great sea fight, there would be many a valuable lesson as to ship construction to be added to those which have already been taught by the battle of Jutland and other fights between capital ships, lessons which it might be entirely possible to incorporate in our new ships when the time comes to carry on their construction.

Let us endeavor to get a proper perspective and maintain a true sense of proportion as we enter this great war. The imminent thing is the submarine menace. Of this there can be no doubt whatever. Upon its success or failure depends the length of the war. The spirit and resistance of the German people will rise or fall with the rise or fall of the totals of ships destroyed. The eyes of the people are turned more to the U-boats than to their armies. A defeat of Tirpitz would bring deeper despondency, just now, than a retreat of the Hindenburg armies.

Let us remember, then, that so far as our assistance to our allies is concerned, a single destroyer in the U-boat zone is a greater asset than a dozen battleships and battle-cruisers on the stocks.

Our Artillery and Our Allies

SINCE the present war is, first and last, a war of artillery, it is extremely important, now that we are committed to the conflict, that we should make the right selection of types in providing our new armies with rifles, field guns and howitzers.

When we send these armies to Europe, it will be with the intention of having them coöperate in the most perfect manner with the French and British armies already in the field; and if we are to function with full efficiency as part of the great offensive, whose object it is to drive the Germans out of France and Belgium, our armies must use artillery and munitions of the same standard type as those of our allies. Otherwise, if we go ahead independently manufacturing our own standard rifles and our own types of field guns and howitzers, we shall be inviting an enormous amount of delay and confusion, both for ourselves and our allies, in getting supplies of ammunition to the front during the strain upon transportation which occurs before and during a great modern battle.

During the war Great Britain, for instance, has designed and built in enormous quantities, an entirely new equipment of rifles and artillery; and a very large part of this has been and is, indeed, still being built, in this country. So large, indeed, have been the foreign orders, that for one weapon built for our own use during the past two years, we have built probably at least fifty for our allies. Consequently, our gun shops and munition plants are fully equipped with all the necessary gages, lathes and other machinery necessary for turning out equipment for our new armies. Our munition makers are familiar with the standard types, and after the enlargement of our plants which is sure to result from our entrance into the war, we shall be perfectly well able to take care of our own needs as well as theirs, and shall be in a position to have the whole of this equipment ready just as soon as the new armies are trained. So that on the score of speed, economy and quantity of output, there is everything to be said in favor of our adopting the allied standards as our own.

The most important consideration, however, is the great saving of friction, delay and confusion in the field which will result from the adoption of a common standard. If our rifle is the same as the British and our field guns and howitzers are the same as the French, it will not be necessary to keep the ammunition destined for our own forces in the field separate from the consignments intended for our allies. Any expert in transportation will realize at once how greatly the rapid handling of the enormous quantities of rifles, guns and shells, which must be carried from our factories to the allied front will be facilitated, if the armies have the same standard equipment.

The existing equipment of the United States Army can be utilized for our home defenses, and the adoption of the allied equipment can be limited to the armies which we send to the European front. For all practical purposes in modern warfare there is very little to choose between the rifles, field guns and howitzers of the various powers, unless we except the famous French seventy-fives. Our own Springfield rifle is a most excellent weapon and its velocity is somewhat higher than that of the British rifle; but seeing that in the present war the rifle is only used at very short ranges, a little more or less velocity does not seem to be of much account.

Everyone seems to be pretty well agreed that it is highly important that we should get started right and we are anxious to avoid the errors and profit by the lessons of the Allies. Here then, in this matter of the standardizing of equipment so that it shall match that of our allies is one of those vital questions which should receive our immediate consideration.

Recent Supreme Court Decisions Affecting Rights of Patentees

ON April 9th the Supreme Court delivered two important decisions, in one case denying the right of the maker of a patented motion picture machine to compel purchasers to use only certain unpatented films, and in the other case, denying the right of the maker of a patented phonograph to fix the price at which the machine would reach the "ultimate user."

If these decisions mean what many believe them to mean, then the exclusive rights secured to patentees by United States patents issued in accordance with the laws passed by Congress, by authority of the Constitution, have been given a body blow. Apparently, these decisions take away from the owner of patented property the right to dictate the terms upon which he is willing to permit others to use that patented property, and while the language of the opinion would seem to indicate that such was the intention of the court, yet we are constrained to interpret those decisions as applying only to the questions which were before the court and which concerned not so much the question of the possession of this right on the part of the patentee to dictate the terms upon which he will permit his invention to be used, as the particular method adopted in the cases which were before the court. In those cases, in what was practically a sale of a patented machine, there was an attempt to burden that sale with a notice of an alleged license, which notice was attached to the machine.

The question as to whether such a notice in the case of the sale of an article for resale, constituted a binding contract, had been disposed of by the Supreme Court and finally settled in the case of Bauer vs. O'Donnell, known as the Sanatogen case, wherein it was attempted by such a notice to bind the retailer to fix a minimum resale price. The present cases are somewhat like the Dick case, which in unmistakable language the Supreme Court says, is overruled, and while in all of these cases there was apparently what might be termed a restricted sale of the machine, yet in the two recent cases it clearly appears that there was an attempt to carry this restriction into the hands of the ultimate consumer through what might be called the jobber and retailer.

As Mr. Justice Holmes forcibly puts it in his dissenting opinion, there is apparently no difference between patented property and any other kind of property which one owns, and it is hard for us to understand how any law can take one's property and permit another to use it excepting on terms dictated by the owner. "If I own a house and another desires to rent it, it is perfectly clear that he can rent it only on my terms."

There has never been any question as to what is protected by a patent, and the court but states a long and well settled accepted proposition of law when it states that a patent protects only the thing which is shown, described and claimed, but it is that thing, which by that patent, one is within his rights in excluding every one from making, using or selling, and if he so desires, the patentee may say, "I will permit no one to make, use or sell my invention," and the Supreme Court will protect him in that course, as it has done time and time again.

If the subject matter of a given patent—a picture machine for instance—is so far superior to any other picture machine on the market that those desiring a picture machine believe that they must have the picture machine of a particular patent, and there being only one place to which they can go for such a machine, can it be said that the owner of that patent as a condition of his permitting another to use the patented machine, cannot require as a provision of his lease and license to use, that the lessee procure from him supplies which may not be patented; and that he shall not use in that machine supplies of a similar nature not procured from the lessor. Apparently, this is what the decisions of the Supreme Court say is unlawful, but as before stated, we do not believe that it was the intention of the court so to decide. We cannot believe that such a contract between the owner of a patent and one desiring to use the thing protected by that patent, is not a perfectly lawful contract, and it was not such a contract which was declared to be unlawful in the recent decisions, but only an attempt to turn a conditional sale into such a contract.

We are glad to see that the Supreme Court did not rely upon the Clayton Act, but even the Clayton Act does not go so far as the language of the opinion would indicate that the court has gone. The Clayton Act says in substance that such contracts concerning patented machines are unlawful, only when they tend to create a monopoly in restraint of trade. We have asserted several times our opinion that the Clayton Act is unconstitutional, for the reason that it apparently affects the exclusive rights secured by a patent and takes away from a patentee the right to dictate the conditions under which he will permit another to use his invention, so that such a patent is no longer the exclusive patent contemplated by the framers of the Constitution. It was their intention to give to Congress the right to legislate for the grant of exclusive patents only and Congress gets no authority from the Constitution to legislate for the grant of any other patent excepting an exclusive patent. If the Clayton Act, therefore, takes away from a patent any part of the exclusive rights which the framers of the Constitution clearly intended that a patentee should have, then as before stated, we believe that law to be unconstitutional.

Notwithstanding the decisions of the Supreme Court, we believe that when the question of a direct contract between a patentee and a lessee comes before it, it will be held that a patentee still possesses the right as a condition upon which he will permit another to use his patented invention, to make any condition for his permission to use, that he sees fit. If the condition is unlawful or impossible of performance, that is simply an indication of the patentee's intention that he will permit no one to use his patented invention, and that he can refuse during the life of his patent to permit its use by others, is his right, as has been decided in the Eastern Paper Bag case, and in a long line of decisions.

Electricity

An Electric Stabilizer for Aeroplanes has recently been invented by Orville Wright, according to report. It is understood that this stabilizer discards the usual gyroscope and instead makes use of a pendulum swinging in a liquid bath. This pendulum controls the electric current which in turn controls the stabilizing means.

The Right of Way for Telephone Companies is covered in a bill which has been introduced in the Pennsylvania Legislature, and which gives the telephone companies the right to eminent domain over private and public property. The bill also gives competing telephone companies the right to consolidate.

Lighting Generator for Motorcycles.—A leading electrical manufacturer has just placed on the market a small generator for use on motorcycles to supply current for head and tail lights. This generator is rated at 23.5 watts, 7 volts, and in combination with a regulator will hold its voltage practically constant through a wide range of speed. The generator is totally inclosed and waterproof. It is geared to the engine shaft and at about 1,900 revolutions per minute cuts in on the storage battery which it charges at a 3-ampere rate, with full field excitation up to approximately 2,500. At this point the regulator begins to work and holds the current within 5 amperes up to 9,500 revolutions per minute.

Oldest Cooper-Hewitt Lamp Still Fit for Service.—After having been in constant use for eleven years, eight months and seven days, the oldest type of Cooper-Hewitt lamp in existence and still fit for further service, has been returned to the manufacturer by Dr. E. L. Elmendorf, the celebrated traveler and lecturer. It was returned with the original tubes, states the *Electrical World*, both of which are still in good working order, the vacuum being intact though the glass was slightly discolored from use. The lamp has been used in connection with the making of lantern slides from photographic negatives, enlarging and reducing negatives, making small and large positives on glass or on paper, and for illuminating flowers, copies, maps, machinery; in fact, everything that Dr. Elmendorf has had occasion during the twelve years to photograph indoors.

Why Electricity Bills Are High.—In a bulletin issued by the Sealer of Weights and Measures of Massachusetts, some valuable popular information is given to users of electricity on measures of economy, and reasons why electricity bills are sometimes high, with suggestions for reducing them. The commissioner states that meters are generally blamed for bills that seem unduly high. In reality they are not to blame, but the cause is: (1) dark weather; (2) additional lamps installed, or units of increased size; (3) dim lamps in use; these should be replaced by new lamps and tungstens should be installed instead of carbon lamps; (4) lamps left burning in closets, attics, cellars, etc.; (5) laundry irons, toasters or other appliances used more than usually; (6) defective wiring; (7) machinery that is not properly oiled, and (8) errors in meter reading.

Hydroelectric Development in the South.—Thirteen large sized hydroelectric plants have been planned or begun in the Southern States since the first of February, states the *Electrical Review* in a recent issue. The $5,000,000 plant to be built at Wateree, S. C., by the Southern Power Company, is the largest project. The increasing utilization of water power for electric plants in the East, particularly in the Southeast, is a significant fact of interest not only to the electrical industry, but to all persons interested in conservation and industrial development. The public utility concern which furnishes cheap power through a hydroelectric plant naturally aids in developing the neighborhood industrially, and this in turn creates a wider field for public utility service. If the use of electricity is any mark of progress, the southeastern part of this country is progressing rapidly.

Electrical Sunshine for Farms.—Among numerous efforts toward intensive cultivation of land and increased productivity of crops in England, perhaps none is more interesting than the subsidized experiment in growing cereals and other field crops with the assistance of overhead electric current. The experiments with electrical discharge as affecting agriculture will be supervised and the results tabulated by Prof. V. H. Blackman, professor of plant physiology and pathology at South Kensington, a special grant having been made by the Development Commissioners for this research work, which is to be carried out at Huntington Court Farm, near Hereford. Prof. Blackman is reported to have said that the purpose of the experiments "is to carry to a larger scale the successful work which has been done during the last few years near Dumfries, where in 1916 an increase of about 50 per cent in grain and 85 per cent in straw was obtained on oats as a result from overhead electrical discharge. This was on a small scale—one acre only. At Huntington Court Farm we shall experiment with 40 or 50 acres of cereal and other field crops."

Science

The Formosa Earthquake of Last January.—The central part of the island of Formosa suffered destructive earthquakes on August 28th and November 15th, 1916 Before the damage wrought by these shocks had been fully repaired, another severe earthquake occurred, January 5th, 1917. Authoritative statistics just published show that the latter quake resulted in the death of fifty-two people and the injury of more than eighty, while 124 houses were destroyed and more than two thousand were damaged.

Aerial Postal Service.—Plans are now on foot in Europe to utilize for postal service, after the war, a great number of the aeroplanes which the various nations have acquired for military purposes, as well as the services of the many skilled aviators who have been trained since the war began. In France, a large civilian committee, of which M. d'Aubigny, of the Chamber of Deputies, is chairman, has had this subject under consideration since the first of the year. Simlar plans are being discussed in Spain, and the Spanish Minister of Posts has begun negotiations with a view to securing some of the surplus aircraft of France for use in the Spanish postal service.

The Bulletin of Foreign Agricultural Intelligence.—During the past six years the Canadian Department of Agriculture has been publishing, under the foregoing title, a valuable monthly journal consisting chiefly of extracts from the publications of the International Institute of Agriculture in Rome, but also of some other eclectric material of interest to farmers. This periodical, which served the double purpose of acquainting Canadian farmers promptly with the latest important advances in agriculture throughout the world and of promoting the idea of internationalism, has unfortunately been discontinued by the Dominion Government, as a measure of economy. It is announced, however, that the best features of the Bulletin will be transferred to the Agricultural Gazette, another official publication of the Department of Agriculture.

New Quarters Needed for the Fisheries Bureau.—The premises occupied by the Bureau of Fisheries, in Washington, are a close competitor to those of the Coast Survey and the Patent Office in point of inadequacy and unsuitability to the needs of their occupants. In a recent letter to Congress, appealing for better quarters for the Bureau of Fisheries, the Secretary of Commerce calls attention especially to the need of a well-equipped laboratory and aquarium. The Bureau is doing splendid work in increasing and improving the aquatic food resources of the country, but could do much more with proper facilities for conducting experiments. Last year there was heavy mortality among the 4,500,000,000 eggs collected for hatching, but the Bureau was not in a position to investigate the causes of this loss. It is certain, says the Secretary, that the culture of fish in ponds on farms will assume importance within the next few years, and the farmer should have at his command the best brood stock obtainable It is therefore timely to undertake breeding experiments with a view to improving the races of fishes in respect to size, vigor, rapidity of growth and edible qualities. Nothing has yet been done in this direction. In short, a first-rate institution for fishery investigations is needed, for reasons analogous to those that led to the creation of agricultural experiment stations. Incidentally, a national aquarium would prove of much educational value to the public.

The Federal Meat Inspection Service.—Inspection of meats by the U. S. Bureau of Animal Industry is regularly carried on in about 850 establishments, including nearly all the important slaughtering and packing establishments in this country. In the past five years the number of cattle, sheep, swine and goats given both ante-mortem and post-mortem inspection has exceeded 58,500,000 per annum. The average number of whole carcasses condemned during the same period was more than 262,000 per annum, while the number of parts of carcasses condemned was very much greater. About 18,000,000 pounds of meat is condemned every year on reinspection, on account of having become tainted, rancid or otherwise unfit for human food. The total cost of inspection to the Government averages less than 6 cents per animal inspected. A little army of 2,650 persons conducts this important work. Unfortunately the Government service extends only to establishments engaged in interstate and foreign commerce, and to imported meats. About forty per cent of the meat slaughtered in this country gets no Federal inspection, and it is well known that much of this gets no inspection at all. To make the situation more serious, establishments subject to Federal inspection tend to exercise such care in the purchase of animals as to reduce condemnation to a minimum, the result being that animals of doubtful soundness are diverted to establishments operating without inspection. There is urgent need of more general state and municipal inspection, and the establishment of central municipal abattoirs where proper inspection and sanitation may be maintained.

Automobile Notes

The Farm Tractor Opportunity.—While England is keenly alive to the value of farm tractors, and the British Government has a commission to promote its use, we in America are giving the matter little attention. If only for its effect on the future standing of our manufacturers they should make wider efforts to disseminate information relating to tractors.

What the "Breaker Strip" Does for the Tire.—What is termed a "Breaker Strip", in some form or other, is a component part of most automobile tires, but the average user appears to have an incorrect impression of its function, believing it is put in to add strength to the casing. This is not the case, for it is intended as a sort of armor to protect the fabric of the tire from injury Being made of tough, close-woven fabric, and lying between the tread and the structural fabric of the tire, the breaker strip protects the latter from the traction strains resulting from the pull of the tread on the road, and also to a large extent stops the penetration of sharp stones and glass before the tire fabric is reached, thus preventing the entrance of water and dirt, which do so much injury to this fabric.

The Automotive Engineers.—One of the most important movements in the interests of internal combustion motor development is the combination with the powerful Society of Automobile Engineers of the American Society of Aeronautic Engineers, The Society of Tractor Engineers and engineers of the company members of The National Association of Engine and Boat Builders. The new combination will be known as The Society of Automotive Engineers, and its activities will comprehend practically every form of mechanical apparatus operated by an internal combustion motor. Such a combining of interests should be of vast value not only to the manufacturer but to the using public as well, for, through interlocking technical committees, immense resources of information and experience becomes readily available, and standardization becomes possible that could be effected in no other way.

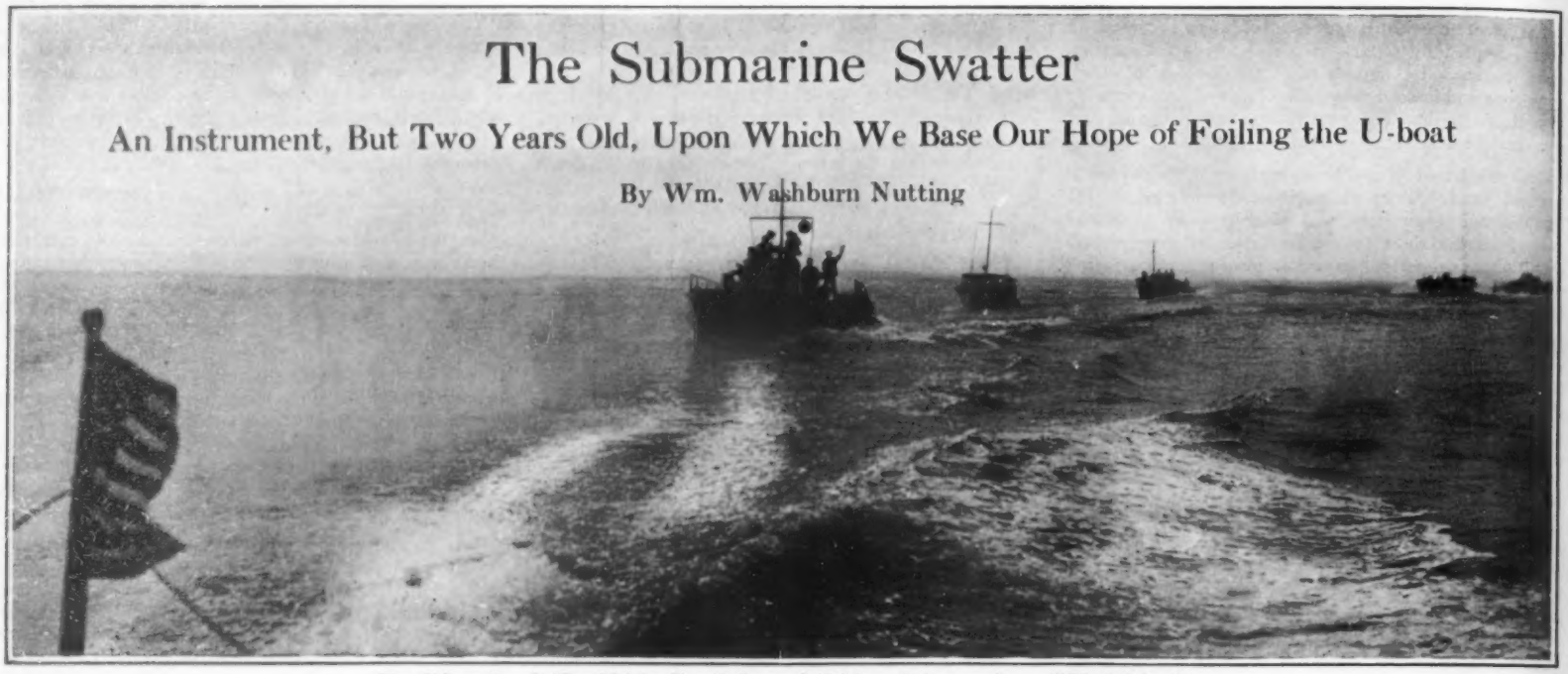
Developing the Farm Tractor.—The world-wide shortage of food supplies has powerfully stimulated plans for the development of the farm tractor, not only in this country but wherever agriculture prevails. A few people have for years appreciated the value of a power tractor for agricultural work, and indeed its absolute necessity on large farms where it is impossible to secure enough labor; but unfortunately many of the earlier attempts to produce such a machine were made with entirely inadequate knowledge of the requirements, and still more unfortunately many people went into the business solely to make something "to sell to the farmer." The result of turning out unsuitable machinery, and shoddy contrivances, has been to give the proposition a bad name, and to greatly delay the introduction of this class of machinery. Now, however, that the recognized engineering associations of the country have taken up the problem in earnest, satisfactory designs should be soon forthcoming. Even now a few manufacturers are producing excellent machinery, in fact the best of its kind in the world, and with the improvements that will come with special expert study, America should easily become the leading producer of farm tractors.

Economy Claims.—The wonderful mileage records obtained by the expenditure of a single gallon of gasoline announced by some automobile manufacturers seems to be poor advertising, for everyone knows that the private car driver never equals those results, and consequently the owner becomes dissatisfied, and thinks a defective car has been palmed off on him. The fact is that while the record claimed may be absolutely correct, the conditions of the test do not conform to ordinary, every-day operation. Sometimes it may be that a regular stock car was used for the test, but operated by an expert driver, and by this means alone excellent results may be obtained. But there are other methods, some, or all, of which may be used. A few of the things that will secure fine records are as follows: Even in the best factories some cars will run better than the average Selecting one of these exceptional cars, it may be gone over from one end to the other, and every bearing carefully cleaned, and adjusted rather loose. Instead of thick grease special thin oil, even in the gears, differential and wheel hubs will help immensely. The engine is cleaned out, and the valves, valve and ignition timing carefully adjusted. The carburetor receives special attention, for it is set to give just the amount of gas that will run the car at its most economical speed—and when making the test the car is held accurately to the intended speed, and on a smooth, level road where there will be nothing to interfere with its speed. With such preparation, and with a driver who is expert in "nursing" his engine, and much lies in that, it is not a difficult matter for most any car to roll up an economy record that is almost unbelievable. It is not claimed that this is the way all economy records are made, but it is safe to say that none are run under average amateur conditions; and the best guide in buying a car is general reputation, rather than on the results of special tests.

The Submarine Swatter

An Instrument, But Two Years Old, Upon Which We Base Our Hope of Foiling the U-boat

By Wm. Washburn Nutting



The Chingachgook (flagship) leading the second division of the squadron off Block Island

OUT of the welter of stupifying things which have crowded the past thirty two months, one fact stands sharply and with ever increasing moment—and that fact is the German U-boat. From a practically untried instrument at the beginning of the war, the submarine gradually has come to be the biggest factor of the conflict, upon the success or failure of which in its present undertaking, the whole future course of history depends.

Foiled in her stupendous effort to force a decision with her armies and with the war on land at a practical deadlock, Germany has looked to her *Unterseeboot* for a last chance of victory, and her success or failure will depend upon whether or not she can build, equip and man her under-water fighters at a greater rate than that at which they can be destroyed. She has been quick to appreciate the advantages of the so-called "manufacturing system" in this connection, and it is safe to say that all other considerations have been subordinated to this one end and that every yard in the empire is working day and night on the production of standardized submarines.

In an editorial in the April 7th issue the SCIENTIFIC AMERICAN, reviewing the capacity of the German yards, says that it is probable that there are 1,000 submarines under construction at the present time. It points out, further, that in the matter of supplying Diesel engines as well as the optical and other equipment for such craft, Germany is peculiarly fortunate, and that her idle high-seas fleet can supply the men as they are needed.

Now with six months as a conservative estimate of the time required to build a submarine the gravity of the present situation is obvious. What if England has, as some claim, destroyed or captured 100 or even 200 U-boats since the beginning of the war? Is this sufficient grounds for the belief that she can unaided break up the blockade that aims at her starvation? It seems to us that it is not.

In view of the situation, our part in the war probably will be something more aggressive than the mere defense of our harbors and coastwise shipping from the ravages of the U-boat, which alone is a big undertaking. Naval men seem unanimous in their belief that we should strike across the water and, now that we have frankly entered the war with the purpose of bringing the Prussian Autocracy to its knees, it may be that they are right. That the President holds this view seems likely from his war address to Congress, in which he cites as our first duty "The immediate full equipment of the navy in all respects, but particularly in supplying it with the means of dealing with the enemy's submarines."

Now what does this mean? At the outbreak of the war there was no specialized instrument for combatting the submarine, with the exception of the torpedo boat destroyer. Some authorities still cling to the destroyer; but this is a large expensive vessel with more speed than has been shown by experience to be necessary for this work, and with no greater destructive ability than might be had on a much smaller vessel. It would take too long to build an adequate fleet of such boats, even if the expense were not prohibitive.

Others place their trust in the aeroplane or flying boat for coast patrol; but while the flyer is indispensable for scout work because of its peculiar ability to detect a submarine even when it is traveling submerged, and while it should form an important part of any system of coast patrol, it is hardly the instrument to do the actual work of fighting the U-boat. I do not wish to under-rate the value of the aeroplane, even as an aggressive instrument. Armed with bombs which might be so designed as to penetrate a considerable depth of water it would be formidable indeed; but the brunt of the work of patroling offshore, day in and day out, for possibly weeks at a time and the work actually of giving battle to the submarine will have to be done by surface craft.

Bow view of Italian chaser showing partial elevation of anti-aircraft gun

Much of the work of patroling the North Sea and the coasts of the British Isles has been done by steam trawlers, a type of vessel used in large numbers for fishing in the North Sea and, therefore, except for its inadequate speed, fairly well suited to the work. But we have no large fleet of steam trawlers and while we have ocean-going tugs, oyster boats and the like, most of our craft, besides the destroyers actually available or building and the comparatively few privately-owned craft which would be suitable for the work, have yet to be built, and it stands to reason that the smallest unit that will do the work *successfully* is the one to choose. Since any system of coast patrol must depend for its success upon many units rather than a few large ones, is it not better to build say twenty-five to fifty boats, 85, 100 or even 125 feet in length, than one destroyer at the same price, especially when the smaller vessels may be had in but a fraction of the time?

The Navy Department has decided this question in the affirmative and has designed and let the contracts for the building of between one and two hundred 110-foot, motor-driven vessels, and besides these it is the intention of the Department to build a number of smaller vessels.

The Development of the Submarine Swatters

Although both the Germans with their *Freiwilligen Motorboot Korps* and the British with their Volunteer Motorboat Reserve were quick to realize the value of the numerous privately owned motorboats for use both with the land and sea forces, the value of specially designed craft for the actual work of hunting and destroying submarines seems not to have been appreciated at the start of the war. The first published idea along this line, so far as we have been able to find out, was a drawing by the writer called "blinding a Submarine" which was one of a series of such drawings published in *The American Motor Boat*, in December, 1914. It showed a fast motorboat in the act of shooting away the periscope of a submarine, an idea rather more visionary than practical. This picture was reproduced abroad and may have had something to do with the demand which almost immediately sprang up for such boats. America had produced the most terrible of all the deadly implements of modern warfare and now we were called upon to devise a means for its destruction.

In the spring of 1915, Russia started the ball a-rolling with an order for 18 high powered 60-footers, which later was doubled. These boats were of the V-bottom type and with their three high-speed engines aggregating 600 horse-power were capable of a speed close to thirty statute miles an hour. They carried a three-pounder amidship and a machine gun forward, but seaworthiness and comfort

Approximate sketch of the new 110-foot submarine chasers

These craft with their good free-board and generous displacement will be able to maintain station in heavy weather

were somewhat sacrificed to speed and mobility.

Then England ordered 50 boats 75 feet in length and before they were delivered increased the order by 500 80-footers of similar design. The result was 550 boats in 550 days from the time the order was received—eight miles of boats—think of it! There's romance enough in a feat like that for a Kipling or an H. G. Wells. And excellent boats were these 80-footers, powered with twin engines of 250 horse-power each and good for 17 knots. Their speed was sufficient for the work and they were fairly livable boats

And then there were other smaller orders for completed boats as well as for motors with which to power the boats under construction in all the Allied countries.

It was not until the summer of 1916 that our own Navy Department began to show an interest in the submarine swatter which the foreign powers were taking so seriously. Realizing that there was something to learn from the architects who had designed these boats for foreign service and wishing to stimulate an interest among private owners who might build boats which would be suitable for patrol work in the event of war, the Department solicited designs for two such boats. The first was to have a speed of 25 miles an hour and was to cost not more than $12,000. The second was to be a 30-miler to cost not more than $28,000. The designs which were accepted were a 45-footer by Mr. A Loring Swasey and a 66-footer by Mr. A. E. Luders, from both of which, boats were built.

Further to stimulate interest among yachtsmen, the Navy Department organized maneuvers for motorboats, which were held last fall in the several naval districts along the Atlantic coast, and a number of enthusiastic yachtsmen, mostly from Boston, the habitat of the species, built boats for these maneuvers. Notably among them was a fleet of seven uniform 40-footers from Mr. Swasey's design, which were prominent in the operations of the Second Naval District. These little boats proved all that could be expected, but were too small for the more strenuous offshore work.

The early idea was that a submarine swatter should be very fast and easily maneuvered above all else, and while extreme speed is no longer considered worth the price in comfort and seaworthiness which must be paid for its attainment, the latter quality is decidedly essential and should not be lost sight of in our tendency toward bigger and bigger boats. Another idea, dear to the hearts of the newspaper writers, was that the boats should be so shoal of draft that they would be immune from torpedo attack. And less importance was placed in the armament, it being popularly supposed that any sort of a gun would do to shoot up the periscope of a defenseless U-boat.

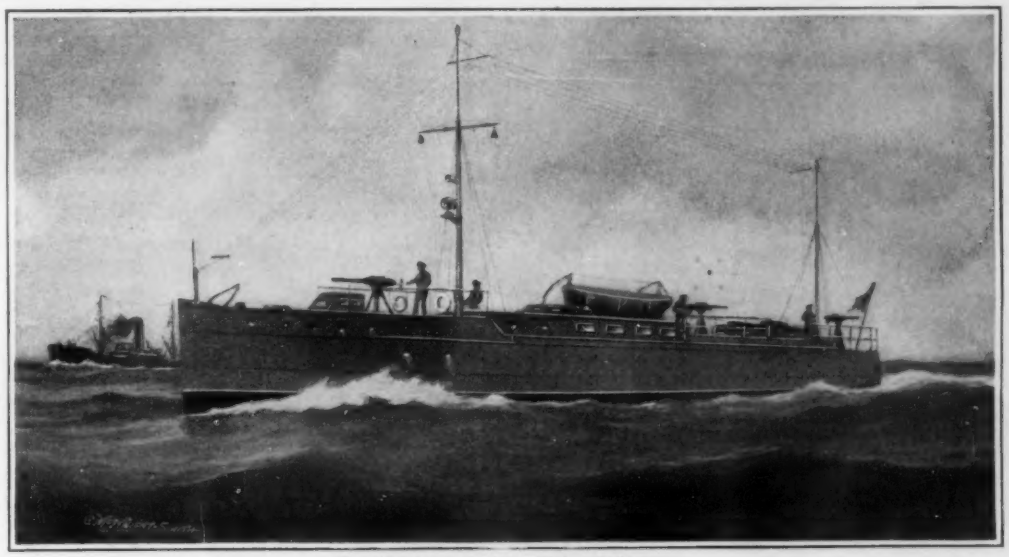
Then, when it was appreciated that shoal draft was more of a talking point than anything else, for the reason that no sane submarine skipper would chance a torpedo on such a boat, and when it was seen that the U-boat was no longer a defenseless, vulnerable thing, but had become an armed and armored fighter, the tendency was toward larger boats. But some designers clung to a form of hull with much faster lines than the available power and the usual condition of the sea would permit them to use. It is not necessary to employ the same extreme form of hull to attain a given speed in a large boat that it is in a small one. Take for instance, the V-bottom form made famous by Mr. W H. Hand, Jr., a form of unchallenged merit for boats up to a moderate size Mr. George Crouch has found that the critical speed at which the V-bottom form becomes more efficient than a well-designed hull with rounded bilges is in miles per hour numerically equal to four times the square root of the over-all length in feet. That is to say, 20 miles an hour for a 25-footer and 40 miles for a 100-footer. For extremely high speed there is, of course, another advantage in the V-form besides its easy driving qualities and that is what might be called its kinetic stability. In other words, the faster it goes the greater its stability, whereas a round-bilged boat driven at great speed, is wobbly.

But for sea work the requirements are different. What is necessary is plenty of under-water body of a shape with considerable deadrise—that is, wedge-shaped in section rather than flat The boats should not be designed, as are most of our fast express cruisers, with a broad, flat afterbody or "run" and fine water lines at the bow It is obvious that the great bulk aft and the lack of it forward makes for erratic action in a following sea when the stern is lifted bodily and the bow depressed. The pronounced reverse flare or "flam" which many designers work into the top sides at the bow is of more use in throwing off spray than in keeping the boat from "rooting." The normal flare, like that say of the Gloucester fisherman, is the thing for a sea boat, and the nearer this is followed in the stern sections, the better. This form of hull might be called the stream-line form—the true displacement type, and it is the type used in the 110-footers which are now under construction.

The powering of these boats was a problem. The Department favored a twin rather than a triple installation which would require medium speed motors of at least 300 horse-power each. But it was found that no such motors were available There were high-speed engines of the express cruiser type, but these would have to be used in connection with reduction gears in order to employ the larger, slower-turning and more efficient propeller. Some suggested light Diesel motors which would be excellent for the purpose, if they could be had, but they are not available in quantities, and the few oil engines of sufficient power are of the extreme heavy-duty type, developing their power at too low a speed for an 18- or 20-mile boat.

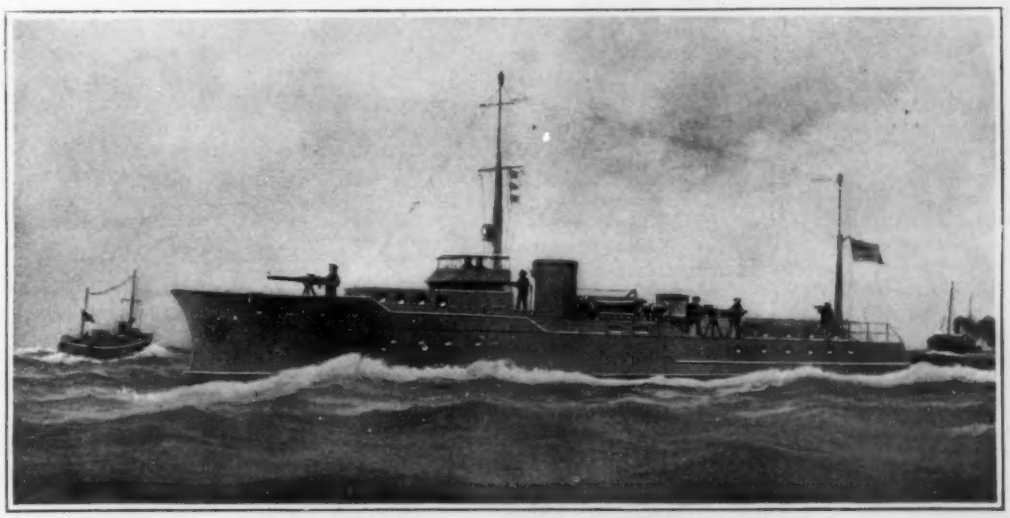
In a talk with Assistant Secretary Roosevelt, the writer was informed recently that no standard power plant had been decided on for the 100-footers and that any-

(Concluded on page 455)



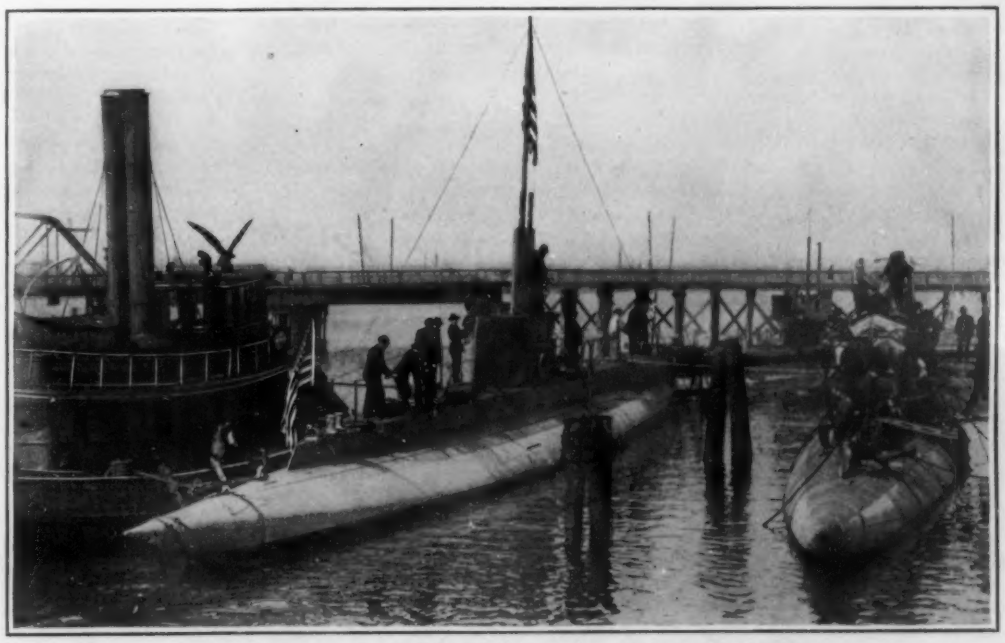
Design for a 75-foot, 32 knot chaser

Length 75 ft . *beam*, 13 ft. 1 in., *extreme draft*, 4 ft., *armament* one 3-pounder, 3 machine guns



Steel scout and chaser; several being built by Herreshoff

Length, 110 ft., *beam*, 15 ft., *draft*, 4 ft 6 in., *triple expansion*, *600-H P engines*, *speed*, 23 knots.
Four of these fine craft are being built at private expense



One of our latest submarines; picture taken just after the launch

Launching of an N-Type Submarine

THE accompanying picture has special interest because it represents one of the latest of our submarines of what is known as the N-type. For reasons, which will be thoroughly appreciated, it is not advisable to give any detailed particulars of this submarine; and indeed, during the period of the war, the readers of the SCIENTIFIC AMERICAN will have to be satisfied with a more general description of pictures relating to the Army and Navy than they have hitherto been accustomed to. Considerations of patriotism and expediency make this restraint necessary.

With regard to the submarine here shown, we can say that it represents the latest development of what may be called the larger coast-defense class, as distinguished from the 800-ton sea-going class for which Congress has recently made such a liberal appropriation. The submarine shown has good speed and a sufficient radius of action to enable it to operate, if need be, at considerable distances from the coast.

Strategic Moves of the War—April 26th, 1917

By Our Military Expert

THE battle of Arras still continues with the Germans being constantly driven back and with new auxiliary positions of the so called Hindenburg lines and in the Champagne region being successively and successfully taken. Despite the Kaiser's thanks transmitted to his son for services rendered in the attacks on the Aisne and in the Champagne, there can be no denying the fact that such a step was taken to appease the people of Germany who have for so long a time looked forward to victory and a triumphant peace The truth cannot be much longer hidden from them and when the awakening comes it bodes ill for the rulers and commanders who have misled them by false information and by practically false stories of German successes A diary of a captured German officer is reported to have contained the following entry: "This is the last and deciding push for we shall soon be able to hold out no longer." Here is evidently the spirit moving the German troops in their present struggle against heavy odds where the proportion of guns alone is that of three to one against them.

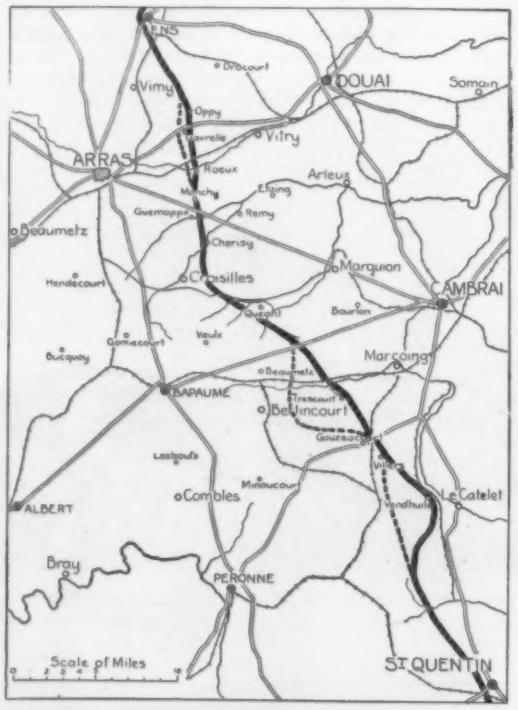
The Hindenburg plans, if there have been any, have certainly grossly miscarried since the British forward movement on the Arras front began on Easter Monday; the first phase so begun ended with the British occupying Monchy-le-Preux, which was a salient thrust forward into German lines. The village is situated on a hill commanding the country for a number of miles to the east. As a consequence it has been the object of repeated counter attacks and heavy gunfire. These desperate efforts show that it has been regarded by the Germans as a key point protecting one of the last parts of the defense line before occupying the Drocourt-Quéant switch leading to the so-called Hindenburg lines. By the capture of Gavrelle to the north of the Scarpe River and of Guémappe to the south of it, Monchy ceases to be a salient, the British lines are straightened for a long distance and progress has been made in destroying the barrier that is defending Cambrai. To the south of this, the British have pocketed the Havricourt wood and by capturing Trescault have removed a two-mile bulge into their own lines. East of Epéhy they have gained ground in a wide front and have reached and crossed the St. Quentin Canal at Vendhuile less than two miles from LeCatelet. This deprives the Germans of one of their principal lines of communication

On the main part of the Arras front from Croiselles all the way to Gavrelle, the British lines have been advanced, they have been pressed forward east of Monchy and have been maintained against furious assaults at and near Gavrelle itself. On the entire Drocourt-Quéant front, the German troops have been used recklessly both in assaults and in efforts to hold the lines; German reserves have been thrown into battle with a prodigality that has astonished both the English commanders and their troops. The superiority of the British artillery is very marked; by its constant fire on the Douai-Arras railway it is very difficult for the Germans to bring up ammunition Around Lens there have been further gains in the vicinity that but tighten the grip of the British on that town.

On the French front artillery still continues south of St. Quentin and east of Craonne, while the Germans still push attacks in the Champagne front especially against the ridges held by the French in the vicinity of Moronvillers. The first ten days of the French advance appears to have been marked by the complete success of the objects of the movement. Only around Rheims where Fort Brimont commands much of the ground in the vicinity of the city can it be said that the forward movement of the French has not been completed. There is apparently no intent to assault this strong position which would be too costly both in lives and materiel; it will be masked and surrounded as has been done in so many other similar cases. The possession of the ridges of Moronvillers, including Mont Haut and other hills, has been a piece of good fortune scarcely hoped for by the French commanders. By quickly consolidating the positions the German counter attacks have been easily repulsed with heavy losses to the assailants. The town of Craonne has also been pocketed by the successes at Vailly, Braye and Juvincourt and the place can be taken at any time without serious losses.

In the meantime, the German counter attacks are losing their force; it looks as though the German officers are finding it more and more difficult to bring their men into line against the strong French positions now occupied. It will be necessary for the German commanders to allow time for their troops to get their shattered nerves into condition before again attempting to face the terrific gunfire of the French that has been met in every counter attack. Much has been said about the Champagne advance having now ended; this supposition is quite fantastic in view of the continued French activities It would seem rather as if the operations of the British and French were timed in unison; when the British advance stopped at Monchy, the French began on the line from Soissons to Rheims and beyond. Now that they are taking a breathing spell, the British take Gavrelle and Guémappe and cross the St. Quentin Canal. It is a merry dance that must ultimately wear down the staying powers and resources of their opponents.

How long the German people will endure their present privations at home and the apparently endless slaughter of the best blood of the land at the front is a great problem. Present conditions in Germany could hold only in a country so thoroughly ruled from above that all ills in the name of the Fatherland are borne as a proof of patriotism. But an end will come to this in time, as the most powerful of its Allies (Austria) is apparently becoming restless and its people are becoming more and more desirous of peace, especially as they now see they are fighting for a German cause. Destitution and poverty are everywhere prevalent especially in Southern Austria and along the Adriatic. From all reports it is doubtful if the people of Austria-Hungary can hold out till the new crops are gathered. The same cry comes from Turkey and Bulgaria; Asia Minor and above all Armenia are in the throes of famine. However favorable a view be taken of present conditions, there can be no denying the fact that Germany and her allies are daily growing weaker both materially and financially; it is now only a question of time when exhaustion in men,



The Arras battlefield, showing line of April 26th and (dotted) that of April 19th

food and money will force an end to a war that should never have been begun.

Disaster has again been the portion of the Turks in Mesopotamia as General Maude reports the rout of the 13th Ottoman Army Corps 70 miles north of Bagdad on April 17th. This defeat was the result of the flanking movement several days ago when the Turks, by a night march of the British troops, were driven from the triangle of the Diala River. The British commander then crossed the Adhem River, a tributary of the Tigris, and attacked the enemy at a railroad station about twelve miles from Samara with great success. On April 24th, after repeatedly repulsing hostile attacks, the badly defeated Turkish army was driven entirely out of Samara, where, despite efforts to destroy them on the part of the Turks, quite an amount of railroad material and military stores was captured. The pursuit is now being vigorously pushed and there is every prospect that the combined Russian and British forces will envelope what is left of the once strong army that held for so long a time Bagdad and the lower Tigris. Samara is the terminus of the Bagdad section of the Berlin-Bagdad Railway which had been built north to that point. Mosul is 85 miles to the north; but between Samara and that place there are only caravan trails.

As the Russians have also entered the vilayet of Mosul at the north and are moving on that town, there seems no prospect of escape for the Turks. Both the British and Russians seem determined to bring the campaign to an end as early as practicable, for climatic conditions in Mesopotamia in the summer months are trying, in the extreme. All preparations for a summer campaign, however, are being made; the British are apparently arranging for iceplants, refrigerating barges for meat, and all other essentials for such an undertaking.

In Palestine the British troops, aided by war vessels operating from the sea two miles distant, cleared a front of six and a half miles and are advancing on the City of Gaza. Below the town the combined British and Egyptian forces are laying a railroad up the seashore with Joppa and Jerusalem as the objects of the advance. The previous defeat of the Turks below Gaza in March permitted the British to establish their lines from the sea across the country to Hebron. Minor operations since the first defeat have added much territory to that previously occupied; the operations now in progress appear to be the final advance on Gaza itself. With the town in the hands of the English, the next move will be an advance of the whole line on Jerusalem and its port of Joppa.

It looks now as if nothing can prevent British arms from establishing their supremacy in Palestine. Once this is done, the entire country will pass under British suzerainty, both politically and commercially. There are in Palestine three nations—a Christian, a Mohametan and a Jewish nation; the supreme power ruling the country must determine the sphere of each, as regards language and the details of independent internal administration. Following the national character, the Jews will have no scheme of conquest; but they will constitute a bulwark against any threats from the north upon British rule in Egypt. What the Jews of Palestine desire, however, is not military strength nor power to rule, but a just and fair administration, that will understand them and their possibilities for development.

If dispatches from Petrograd can be believed, the German plan for a descent on that city has started. These dispatches state that a German fleet of transports and war vessels have left Libau, probably to make a demonstration in the rear of the Russian flank on the Baltic somewhere in the Gulf of Finland and to cut the lines to Petrograd. At present the great Tirul swamp lying between Riga and Mitau, combined with the natural defenses of the Aa River, has rendered the extreme right flank of the Russian lines practically impregnable.

Heretofore this year the effects of the spring thaws in that part of Russia have proved a sufficient protection against military operations; but just now reliable information appears to be at hand that the Germans are also massing strong bodies of troops against the front extending from Riga to Dvinsk. If this be true, and if a hostile force can be landed on the coast between Petrograd and Riga, somewhere in rear of the present line of defense, the latter would be most seriously threatened and the capital might be cut off.

Little of interest has occurred on the Italian or Rumanian fronts, due to blizzards, rains and rising rivers. But again critics are looking for an advance north from Salonica and Monastir having for its object, as so often stated, to cut the Constantinople railway and eventually to move against Austria and Bulgaria. There is no danger now of a German-Bulgarian attack on the Allied forces in and around Salonica; the Allies are in sufficient strength to defeat such an attack if attempted.

In fact, the latest reports speak of heavy artillery fighting and of a British advance between Lake Doiran and the Vardar River which still continues. This fighting would seem to be preliminary to an offensive movement that may extend over the whole Macedonian front. It is more than probable that the French will occupy Greek territory and that France and England will not only refuse to recognize King Constantine's demands, but will probably dethrone him despite any steps he may take. An end to the farce that has so long been enacted by the Greek King will no doubt be made before any extended advance is attempted.

A Department of Commercial Queries

THE SCIENTIFIC AMERICAN has always enjoyed a very wide distribution over the entire globe and it has numbered its subscribers in the most remote corners of the earth. Now that our nation is taking an active interest in affairs beyond our borders, and we are endeavoring to place our wares in foreign markets, the foreign circulation of the SCIENTIFIC AMERICAN has been further stimulated. Very evidently buyers in other lands are showing an increased interest in American products. The Editor's mail is weighted with commercial queries. Foreign readers naturally turn to the SCIENTIFIC AMERICAN for information on American manufacturers.

There is a community of interests between our readers at home and those in foreign lands which we are glad to foster. To facilitate the exchange of information, and to bring the prospective purchaser into touch with the manufacturer, a Department of Commercial Queries has been opened and will be found on page 458. The Editor trusts that this will prove equally valuable to readers in this land and to our foreign subscribers.

Recent Chemical Developments

Making Wholesome Bread Out of Alfalfa Hay

By Ellwood Hendrick

At the Kansas City meeting of the American Chemical Society the different sections met, as usual, in separate rooms and papers were presented according to the printed programs. In the Division of Agricultural and Food Chemistry, paper No. 9 was on the Practical Use of Alfalfa Flour, by Professor E. C. Sprague, head of the department of Home Economics at the University of Kansas. When the title was announced, it occurred to some of the elder chemists from the East that the professor was probably ill or otherwise detained from attendance, and that his daughter had come to offer his apologies for not appearing. In the backs of a number of white-thatched heads there were formulated incoherent regrets for the professor's probable indisposition and at the same time, congratulations to him on the agreeable advent of his daughter. These were possibly more coherent than the regrets. Within a few moments the vanity of their thoughts became manifest in the fact that the professor herself was making the address and that her initial E. stood for Elizabeth. And she had no difficulty whatever in holding her audience.

Alfalfa flour is nothing more than the ground and finely powdered leaves of alfalfa hay. But that's nothing. For many years the alfalfa enthusiast has been abroad in the land and he maintains anything and nearly everything that is good about his favorite grass. Moreover, he believes it; and more often than one would think, he is right. This faith in its universal merit led one of the large farm machinery companies to design machinery for the preparation of alfalfa flour, alfalfa tea, alfalfa coffee and alfalfa so many other things that we dare not mention them here lest our sincerity be attacked.

Professor Sprague undertook experiments to test the merits of alfalfa flour. She dried the leaves of the plant as quickly as possible and pulverized them thoroughly so as to have pure, unchanged alfalfa flour for her baking. The powder, however, contained no starch, had no thickening power and was not a true flour in the sense of the word as applied to cereal flours. She then took ten grams of her alfalfa powder and blended it with 100 grams of white or patent wheat flour and proceeded to make a batch of biscuits. They had the traditional quality of bridal biscuits of the humorous papers, being of a dark, brownish-green color, and the taste of all the back-yard weeds that ever grew—not forgetting skunk cabbage. They were wholesome enough to eat, provided always anybody could eat them. But it seemed unlikely that even an "acquired" sense of taste and smell would call for a second helping. And yet, chemical examination showed that food values which are greatly needed were present. In the first place, there is a comparatively high protein content in alfalfa which is good and desired. This is the muscle-building food principle found in meats, in fish, in beans and to a much less extent in other vegetables. Again, alfalfa flour shows a high percentage of alkaline ash, with calcium (lime) predominant, which is considered by many investigators to be of prime importance in dietetics. The need of adequate and proper mineral content of foods is now constantly emphasized. Bulletin 227 of the U. S. Department of Agriculture states that "If the estimates of the normal requirement and the estimates of the amounts in typical American dietaries are even approximately correct, it would follow that a considerable proportion of American families would be benefitted by a diet considerably richer in calcium compounds than that which they habitually consume." Sherman, a distinguished authority, found in studying twenty American dietaries, that half of them contained less calcium than the body needs.

Calcium is needed for bones and teeth and recent medical observations tend to show that disturbances of internal processes that are involved with calcium, are connected with a number of abnormal conditions. In other words, modern research seems to indicate the need of a higher ash content in foods on the ground that the body can better handle an excess of it than it can meet a deficiency. Another point is that meat, eggs and cereals have an acid ash while the ash of vegetables, milk and most fruits is alkaline. The latter is the type of mineral content that is most especially needed in human foods.

Here, then, the professor had a perfectly good food in every respect except that it takes too much resolution, too much self-denial, too much stomach, too much saintliness or too much of one quality or another for most of us to endure, for instance, as we endure tender roast beef, broiled spring chicken or mince pie, on the way down.

The research chemist, they say, must be born and not made, because the work demands qualities of temperament that are peculiar. For instance, half a column back we reached a point where it would appear to be reasonable to drop the whole subject of alfalfa flour as a food. If it isn't good to eat, what's the use in bothering with it? We have been praising its content of lime, but that is no rarity. Marble gravestones and mortar and any number of other things not generally regarded as table delicacies are far richer in it. But we are taking notes from the paper of a research chemist and the research chemist does not look at things that way. Here was a food, desirable and wholesome, demanded by the human digestive apparatus and made of cheap cow fodder. It was not anything like time to stop. It had the defect of a weedy taste and the point was to get rid of it. Various solvents were tried without much success at first, but finally, with improved apparatus and various little strategems of manipulation, the operation became regular and easy, the cost slight and the product uniform. It is a dark, brownish gray powder substantially the same as it was before in a chemical sense except for a marked decrease in ether extract: from 3.76 to 0. 45 per cent.

When this is mixed with whole wheat flour in the proportion of one to ten the protein is increased 20 per cent and the ash over 30 per cent. If added in the same proportion to white flour the protein is increased 25 per cent and the ash 100 per cent. With corn meal the protein increases 35 per cent and the ash 50 per cent. The weedy taste is conquered, provided the amount used is kept down to 10 per cent or under. With so-called patent or white flour there is a slight but not unpleasant difference in taste and the color is similar to that of bread made of whole wheat or rye flour. Graham bread, with its rather larger proportion of sugar, covers the foreign taste entirely when 10 per cent of alfalfa flour is mixed with it.

The value now becomes evident, in that it materially increases the protein and calcium content of bread. It does not contribute enough protein to make bread take the place of meat or fish or beans for men that work in the open, nevertheless it does distinctly add to its food value. If, through a shortage in wheat we increase our consumption of corn, it will give to corn, which is rich in starch, the very other qualities that it lacks—protein and calcium. It would seem especially desirable for troops in the field to use a cereal flour mixture which has a high mineral content and is basic in character. A mixture with 8 or 10 per cent of extracted alfalfa flour will impart this very quality.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Effect of Certain Recent Decisions

To the Editor of the SCIENTIFIC AMERICAN:

I herein place before you for consideration, and also for publication if you so desire, a matter suggested by the Supreme Court decisions in the cases of Straus, et al, vs. Victor Talking Machine Company, known as the "Talking Machine Case," and the Motion Picture Patents Company vs. Universal Film Manufacturing Company, et al, known as the "Motion Picture Case."

If the law established by the Supreme Court in the Talking Machine case and the Motion Picture case be strictly followed, then the right of a patentee to restrict the rights of a licensee may be abrogated and the right which the Patent Statutes purport to extend, terminated.

Every patentee undoubtedly desires to have the full right which was originally granted by the Statutes. It is very essential that he should have the right to prescribe the place where or the way that a licensee may use or sell the invention, and also that he should have the right to sue for infringement if these restrictions and conditions are violated.

The decisions have now gone so far as to encroach upon and limit the right of a patentee, and consequently the protection afforded by a patent has been materially diminished.

Of course if patents are to be a stimulus to invention, adequate protection must be afforded the patentee.

The Patent Statutes grant to a patentee the exclusive right to manufacture, use and sell the patented invention. These rights, namely, to manufacture, use and sell have long been understood to be distinct and separate. An invasion of any one of them constitutes an infringement.

If the right of a patentee is to be curtailed so that he can no longer prescribe under a license to manufacture any restrictions as to use or sale, the inevitable result will be that the price of a patented machine or article will be advanced because the patentee in order to obtain an adequate reward will either charge a higher price or a higher royalty.

A patentee should at least have the same right as to the price he may charge for his invention as any other property owner.

The purpose of a patent is to give the patentee an exclusive right to his invention so that he may prohibit others from its manufacture, use and sale. If he manufactures or allows other to manufacture while the patent is in force the public receives a substantil benefit, and he is justly entitled to profit and reward.

The trend of the law seems to be to prohibit any restriction upon the use or sale of a patented machine and as a result of the decisions in the Talking Machine Case and the Motion Picture Case the purchaser of a patented machine may use and sell as he sees fit notwithstanding any restriction that may have been imposed upon its use or sale when it was purchased from the patentee.

If the right to impose a restriction upon the manufacture, use and sale of an invention is abolished, all that will remain is the exclusive right to manufacture and this will give very limited protection.

It is difficult to draw any distinction between a case where one acting under a license manufactures the patented machine and a case where he purchases it from the patentee, and the distinction is even less apparent if in the first case he, acting under his license, employs the patentee to make the machine. He always has to pay the price demanded by the patentee and in each instance the same restriction or condition as to use and sale is prescribed. It would not seem to make any difference that in one instance the restriction or condition as to use and sale is established prior to the manufacture of the machine while in the other it is established simultaneously with the sale of the machine.

It is seldom that a patentee ever receives substantial remuneration for his invention and it is most probable that his profit comes principally from licenses granted to others under restrictions as to use and sale.

It therefore seems that it would be well to insure to a patentee the right to prescribe restrictions and conditions as to use and sale so that he may enforce the right expressly granted by the Statutes and realise the reward to which he is entitled for the contribution he has made to the public.

EDWIN B. H. TOWER, JR.

Milwaukee, Wis.

[The Supreme Court decisions referred to in this letter are discussed on the Editorial page of this issue.

THE EDITOR.]

Aeroplane and Submarine

To the Editor of the SCIENTIFIC AMERICAN:

If A. Brancher's model aeroplane with rotating disks for sustaining and propelling same, as described in SCIENTIFIC AMERICAN of February 17th, is a success, enabling the aviator to maintain a practically stationary position in the air, it would seem to be especially adapted to the destroying of submerged submarines that are said to be so visible from the aviator's position above. The bomb from the aeroplane might be dropped free for a chance hit, or it might be dropped with wire attached like a sounding lead from a steamship and if it missed its mark it could be drawn up and dropped again.

W. H. HURLBURT.

Stephen, Minn.

An Acknowledgment

To the Editor of the SCIENTIFIC AMERICAN:

The Bill which provides for the control of the floods of the Mississippi River, in accordance with the plans worked out by the engineers of the United States Army and the Mississippi River Commission, was passed in the last days of the Congress just ended and received the President's approval.

I wish to acknowledge my indebtedness to you for the valuable aid given through the editorial columns of the SCIENTIFIC AMERICAN and to assure you that it is duly appreciated by the people throughout the deltas of the lower Mississippi.

B. G. HUMPHREYS,
Chairman Committee on
Flood Control.

Washington, D. C.

Military Engineering of the Teutons

Building Railroad Bridges of Stamped Steel Sections After the Manner of Erection Toys

By I. K. Dawson

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Austrian pontoon bridge built across the San, Galicia. Refugees are seen here returning home

THE railroad is one of the greatest factors in modern warfare. Many a battle has been fought to hold the lines of steel and many a life has been sacrificed in attempts to cut them.

It is no light task to construct, operate and keep a railroad in repair to stand the heavy military traffic, to say nothing of guarding against the attempts which the enemy makes to put the line out of commission. This work falls to the Railroad Division of the army whose duty it is to build and destroy the lines.

To build a railroad we know is difficult but to destroy one seems to the layman mind a simple matter. Yet do not be deceived; to destroy a hundred miles of line, completely destroy it so that it will be of no use to the enemy, is a task requiring the highest engineering skill.

A German Captain of Engineers told me how how he once sent a green corporal and three men back with instructions to put a railroad station completely out of commission so that it could by no possible means be of use to the enemy. The corporal rejoined the command in a surprisingly short time considering the nature of his task. The Captain asked if he had carried out his instructions. "Ya wohl Herr Hauptman," said the corporal, "The Russians will never be able to use that station again. You see," pointing to a large sack on his back, "I have carried away all the tickets."

The Russians have done so much retreating in this war that ample opportunity has been given them to bring destructive engineering to perfection. A method to be effective must be quick and simple, as very little time elapses between the departure of the last train and the arrival of the enemy's advance guard. Their system is simplicity itself. A dynamite cartridge is bound to every rail joint and exploded. This either breaks the rail off at the fish-plate or bends it out of line an inch or so. A small matter but just enough to make it impossible to use the rail again till it has been sent back to the mill and straightened. I have seen hundreds of miles of rails thus rendered useless in Poland and Galicia.

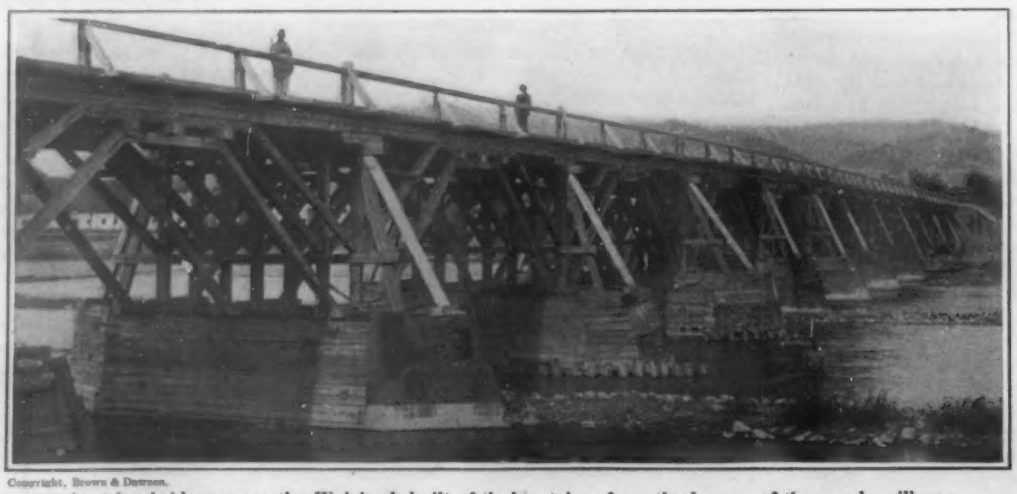
The Russian track is of a gage about a foot wider than the German, which is the standard continental. Hindenburg at one time decided to retreat out of a certain district. In advance of this movement he had all the railroad ties taken up and cut off so that they were just long enough for the German standard gage track but too short for the broad gage Russian. The Russians had to take up the entire line and put down new cross ties, an extensive operation which seriously delayed their advance for many days.

The man-power pile driver hard at work

In a retreat every railroad building is burned, every tunnel blown in and every bridge or crossing burned or dynamited. It is not enough to blow out the piers of a bridge but the spans should be broken in the middle as well. At one point I saw a steel bridge which the Austrians left behind in their first retreat. They had blown out the center pier letting the two spans drop in the middle. Along came the Russians who built up a cribbing pier of heavy timber where the stone pier had stood, laboriously jacking up the ends of the two spans as they went till they were again level and the bridge was as good as new. When they in turn retreated they burned the crib and when I last saw the bridge the Germans were jacking it up again.

In the advance through Serbia the German railroad builders were confronted with a serious problem. The country is mountainous. The railroads follow the rivers through the valleys and cross and recross the streams many times. Serbia is in many parts a treeless country. The forests are gone and there remain only fruit trees and scrub growth too small for construction work. The German engineers in planning this campaign decided that they needed a type of small steel bridge, easily erected and handled and adjustable so that it could be used to span openings of various widths.

The solution of this problem gave us the "Knock down," "Comepackt" bridge, one of the cleverest engineering feats brought out by the war. The idea must have been taken from the erecting toys so popular at the present time; those sets of stamped out steel sections and blocks with which a clever boy can build anything from a sky-scraper to a merry-go-round. The bridge parts all come stamped out and punched and remind one much of these toy sets built on a larger scale. They have reduced their bridge members to a few standard parts which can be assembled to erect a span of from 10 to 100 feet. There are four standard pieces with the nuts, bolts, and washers to hold them together. The parts are made of pressed steel, stamped out and punched in the factory. No cutting, drilling or riveting tools are required for the erection. The work is put together cold and held in place with



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Austrian bridge across the Weichsel, built of timber taken from the houses of the nearby villages

bolts and nuts. The only tools needed for the steel construction are wooden mauls to drive the bolts through and the plates together, and wrenches to tighten up the nuts.

The four pieces used are, a diagonal section about nine feet in length, to form the web of the trusses, a chord section for the top and bottom chords, transverse members or floorbeams to carry the load and an I-beam section on which the cross ties or plank flooring are laid; washers to insure proper spacing of the plates and bolts, and nuts to bind the whole together.

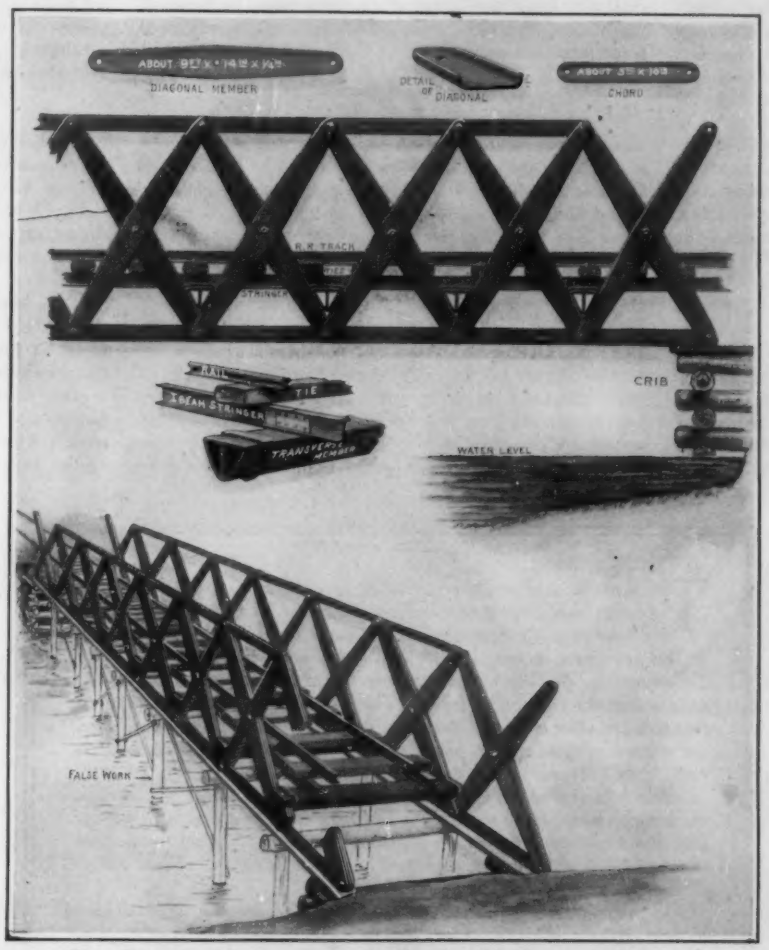
The advantages of this type of construction are many. First its adaptability. The span is built up on the spot to fit any opening. Any pieces left over from one bridge are loaded up again and used on the next. It is easy to have a great store of parts stamped out months in advance, and held at convenient points along the border to be rushed into occupied territory. Under the old system it was necessary to find out with spies the number and size of all bridges which it would be necessary to replace. Then build these bridges in large unweildy sections, which, when shipped into the occupied territory, often did not fit the opening they were supposed to span. Ordinary steel bridges are sent out in assembled sections (as a plate girder) which are so heavy as to require all sorts of hoists and machinery to handle them.

Machinery is always at a premium on the front, but man power is plentiful. No piece of this new bridge is so heavy that it cannot be handled by four men while one man can carry most of the pieces. For this reason unloading and erecting can be carried on with the greatest speed, even where no machinery is at hand. The erecting gangs are drilled till there are no false motions in their work. They work in three shifts and find twenty-four hours sufficient time to throw a 50-foot span across a stream. The construction train comes up to the break, the engine pushing the cars of material ahead. A light falsework is thrown across the stream with material brought along or poles cut at hand. The men are soon swarming like ants on this flimsy platform and like ants we see them marching in line from train to bridge, each man carrying a bridge piece on his shoulder. The trusses grow before our eyes, and in a short time the gap is bridged with steel, the rails laid across, everything tightened up, and the falsework knocked out and loaded up. The construction train now pushes ahead over its own bridge to the next job. Empty material cars are turned over beside the track and picked up later.

Beside the usual railroads we find the field of operations threaded in every direction by what the Germans call "Feld Railroads." These are lines of light narrow gage track something like that used in our industrial plants. It has this difference however; this track, built in 4-foot sections, has hooks on the ends of the rails by which the sections are fastened together. It can be laid down or taken up at any time without the use of tools. There are no spikes, bolts, nuts, or other fastening devices needed. When the hooks on the ends of the rails are engaged the act of laying the section down is sufficient in itself to lock the track sections tightly together. When the utility of the track is past it can be picked up by sections without further ado.

This field railroad has curved sections of different radii as well as switches which can be inserted where needed. In case there is only a slight change of direction the play between the sections will allow for the curvature. The cars used on this track are of a short wheel base but have a very broad floor (about 5 feet square) so that a load of seven or eight hundred pounds can be handled. I never saw any sort of a locomotive used with this railroad other than a patient little donkey which towed the cars.

Usually they are pulled or pushed by man power. The tracks run everywhere, even up to the front line trenches where they are used at night to bring up food and carry back the wounded. This road is shelled by the enemy of course but it is a simple matter to replace the damaged sections of track as soon as night comes. A track of this kind can be laid over rather rough country, a good gang putting it down at about the rate of two miles an hour. Such expeditions are invaluable in military operations.



How German military engineers build railroad bridges out of stamped steel sections

Locomotives That Came Back

AN order of fifty locomotives fresh from the works is good-sized, but when a railroad decides to turn out that number from its own scrap yards the achievement has more than ordinary significance. This has recently been accomplished by the Burlington Railroad in its various shops and the same engines that a year or so ago were lined up on the side tracks in a dilapidated condition are now serving branch lines in various parts of the Middle West.

A quarter of a century ago the biggest locomotives were little eight-wheeled affairs. One who has noticed their long, low appearance and narrow boilers will not soon forget them. These engines pulled the big trains of their day and ran on every line in the country. The iron leviathans of the present time had not been thought of. Trains were composed of three or four coaches for the most part and traffic had reached but a small portion of its present size. The little locomotives did service because there was no call for anything better.

But year by year the main lines of the roads secured more traffic, trains grew longer and cars heavier and the little engines that had done their service so well a few years before were crowded off. The Atlantic and Pacific types of locomotives took their places and the little "eight-wheelers" were gradually side-tracked as they wore out. Every railroad has found them accumulating, so great has been the revolution in locomotive building.

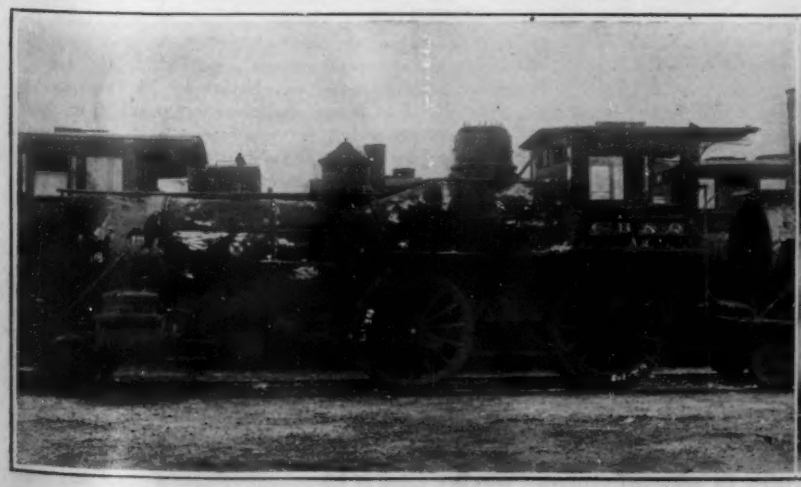
But they are coming back. The building of fifty engines out of their derelict predecessors proves that uses may be found for everything if one looks far enough. As the larger engines came into use on the main lines, such of the "eight-wheelers" as could be used did service on branch lines. And that is where the fifty locomotives are being put to work. The branch lines of the present day may be compared to the main lines of twenty-five years ago and the extension and growth of service on these small lines naturally bring a demand for engines that can be operated without too great expense.

When it came time to reclaim all of these locomotives from the scrap pile it was found that the frames were for the most part entirely good. New boilers consequently were bought and the old engines taken down part by part. Generally speaking with the exception of the boilers all the other parts of the new engines were saved from the scrap pile. The good parts from the old locomotives were assembled just the same as in building entirely new engines. Even the old boilers were not entirely lost for many of them were made to do service in round houses and shops where there was no necessity for high steam pressure. While at first sight the new locomotives appear shorter than the old, in reality they are not; the fact that larger boilers were used makes them appear so. About one third the cost of new locomotives was saved by the plan; and the engines are pronounced vastly superior to their forerunners, and altogether the equal of any of their size built entirely new at locomotive works.

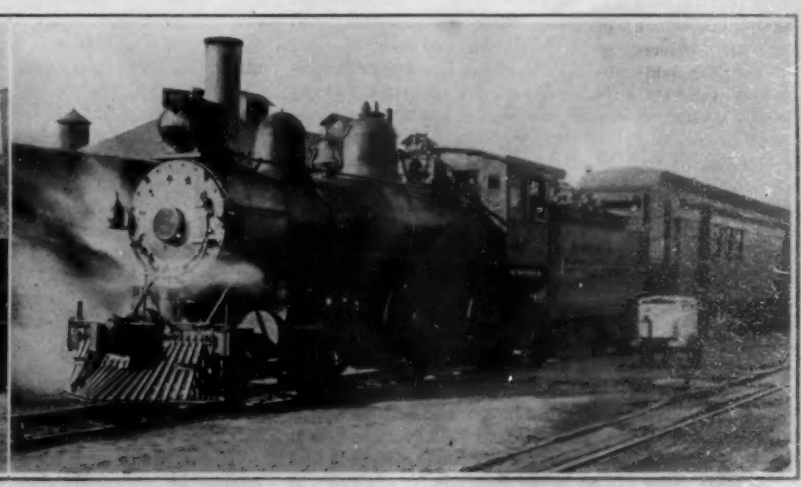
The Advent of the Oil Boiler in the Galley Range

KEROSENE for fuel, replacing coal, has been in constant use in the galley range of the tender "Daisy," of the United States Bureau of Lighthouses, since May, 1916, with excellent results, and has been found more satisfactory than coal. The system installed consists of a standard type of oil and air tank as used with vapor lamps, connected to a horizontal oil-engine starting torch. The nozzle of the torch is located just inside of the front door of the fire box of the range, the flame passing through a 2½- by 6¾-inch hole in the front fire brick, and being directed onto a special curved fire brick. The ordinary stove fire brick is permitted to remain around the side of the fire pot in the usual manner, and false brick is installed above the grate to fill up the space around the burner.

From seven to ten minutes are required to start the apparatus and heat the stove to a proper temperature for cooking, and a meal can be prepared in about one fourth the time consumed by the old method of using coal. The consumption of kerosene is about one quart per hour, but the burner is not in use more than 3½ hours per day.



A locomotive of 25 years ago in the railroad scrap yard



A scrapped locomotive restored to life and in service on a branch line

What I Can Do for My Country

III. The Mechanical Engineer

THE whole engineering profession falls naturally into two great branches. On the one hand stands the mechanical engineer—the man engaged in the designing, construction, installation and operation of machinery and mechanical appliances, of things that must be made to move; on the other we have the civil engineer, the man who grapples with the problem of putting up structures which must be kept from moving. In this classification the electrical engineer appears where he belongs—as just one particular kind of mechanical engineer. But he is of such importance that we usually elect to consider him apart; and accordingly he is usually excluded when we speak of the mechanical engineer. There seems no valid reason why the hydraulic engineer, the locomotive builder, the internal combustion engineer, the automobile engineer, the steam machine design man, the ship builder, the designer of big guns, the aeroplane engineer, the machine-tool maker, and so on almost *ad infinitum*, should not insist upon the same recognition as a fundamental unit of the engineering profession. But since they do not, since their very societies and the universities which constitute the chief source of supply do not accord it to them, we may very well refuse it here, and group them all under the generic title of mechanical engineer.

We might conceivably take up separately each of the score or more major fields included under our general caption, and tell the workers in each what the nation needs that they can give. But there are so many generalizations applicable to the whole body of mechanical engineers that we prefer first to go about the matter a little differently, leaving any special remarks addressed to smaller groups till later. For purposes of wartime service, the mechanical engineers of the country fall into two broad categories—those who will best serve the country by retaining their present employment, and those who can profitably be mobilized to work for the Government. As in the case of chemist and electrical engineer, we do not mean to imply that any mechanical engineer will be doing well actually to enlist in Army or Navy; he would in fact do very poorly thus. It is merely that the direct needs of the Government for mechanical engineers are so heavy, and will become so constantly heavier as we proceed with the business of war, that large numbers of these men must be found, somehow, somewhere, who can be detached from their present work.

The Mechanical Engineer in Government Service

Until the situation has developed more fully it is not possible to specify with confidence and completeness exactly what men the Government is going to need. We can only lay down certain general principles. As one of these, it is plain that first among the Governmental requirements which must be met either in normal or in abnormal measure are those for men to block out the work of Government construction and of contract construction for the Government. We are accustomed to look with a degree of awe upon the vast technical attainments of the naval constructor and the designer of big guns. We are too apt to overlook the fact that when either of these gentlemen—both, of course, mechanical engineers—gets through with his work, the services will be required of a number of other mechanical engineers, less in the public eye, but no less efficient and necessary in their work, to produce the special machinery and tools which are prerequisite to the starting of work on the battleship and its armament. We are even more apt to forget that the designing of a carriage for field guns, of the power plant for a coast defense station, of chassis and engines and transmissions for every sort of special service of which the automobile is capable, as well as of dozens of even less technical appliances essential to our armed and unarmed forces—we are even more inclined to forget that all this work calls for the labors of the mechanical engineer.

More and more, as we go upon an efficient war basis, our equipment will be Governmentally designed. The demands of the Federal service for mechanical engineers competent to lay down all manner of work will be constantly enlarging. Likewise in connection with actual manufacture the Government engineering force must be augmented in direct ratio with the increase in production. If an article is to be made in a Government factory, it is of course necessary to have competent mechanical engineers in charge. If the factory has first to be built there will be heavy demands for engineers to plan the machinery and supervise its installation.

No less will be the drain upon our engineering resources if contract manufacture is to be resorted to; for this will involve an expansion of our inspection forces. Now the mechanical engineer is not necessary in the official inspection of canned meat, of blankets and shoes, of horses, of raw materials with a few exceptions. But in the inspection of gas engines, of automobiles and motor trucks, of aeroplanes, of guns and ammunition, of tools and apparatus for the army engineers, of many other items, he is plainly necessary. As our Government places contracts for such things, it must be prepared to establish inspection corps comprising large numbers of mechanical engineers, and these men must be prepared to go into that corps.

Engineer and Bureaucrat

This brings up the sore question of how a well-intentioned, competent and public-spirited citizen, able and willing to help the Government where he sees the Government needs help, can ever induce the Government to put him in the way of giving that help. We all realize that such a person is undoubtedly subject to much official petty-fogging, and that if he be not possessed of a persistent patience far superior to that of Job, his efforts to project himself into the public service may only get him hopelessly entangled in the official red tape. But while all this is regrettably true, there is another side to the picture. This side shows a group of cabinet officers and subordinates, unable to fix their best energy and attention upon the needs of the country and the ways in which they should be met, because of a raving mob of excitable persons loudly demanding that they be put to work instanter at the business of saving the nation, and absolutely refusing to recognize the fact that, before they can do, someone else must plan.

There is truth in both sides of the picture; and the engineer must read his lesson from the second side. He must be content to take the same position with reference to the Governmental departments that the skilled laborer takes with reference to him. Before the engineer can meet the demand of the mechanic that he be given a machine to run, it is necessary to develop the machine; and this takes time. Before the men who are running this war can set definite plans, problems and jobs before the engineer, they, too, must work out the general direction which prosecution of wartime activities is to take; and this, too, requires time. The engineer must wait for his job as patiently as the mechanic.

The Engineering Inventory

The engineer, however, need not wait for his job as idly as the mechanic must wait for his. He can do much to set his house in order against the hour when the call comes. How many mechanical engineers are there in the United States, and where are they? How many of them are now engaged in one of those preferred war activities of which any thinking person could, with reasonable accuracy, draw up a list? How many could be instantly mobilized at various given points? How many, and which ones, are competent to oversee the manufacture of a 12-inch gun or a standardized cargo ship or a 60-horse-power gas engine? Countless questions of this kind must be answered before we can have intelligent mobilization of our engineering power.

Through any such medium as a general census they cannot be answered; they must be answered through an engineering census. Columbia University, for one, is taking such a census of its graduates and students; the American Institute of Mining Engineers and the American Chemical Society are covering their fields; other organizations which we do not deliberately omit to mention are doing their share. Every engineer and engineering organization should make due contribution to this work. If your organization, your university, are not doing their share, kick them into activity—if the officers will not move, take the matter out of their hands and move it yourself. Do not for a moment suppose that it is enough to sit back and wait for actual engineering work to be thrown at your head; jump in and do your share of the preliminary work, which in your field consists in making instantly accessible the complete analysis of our technical man-power.

Will You Come When Called?

Another way in which the individual engineer can do his part is by preparing himself mentally to accept the call, no matter in what form it may come. He should recognize that governments are in the eternal nature of things more bound up in red tape than individuals or even corporations. There is no valid reason why a man should kick over the traces at the suggestion that he present himself at a civil service examination in his special field—even though he may be universally recognized as the supreme authority upon that subject. He should realize that while individual members of Governmental bodies know this, while his prospective superior officers are aware of it, there are probably excellent reasons why they cannot recognize it officially. He should realize that the damage to his dignity in passing through the prescribed mill leading to qualification is more imaginary than real; he should be prepared to take the candle with the game. He must answer the call which he is best equipped to answer, and in answering it, comply with the conditions laid down as readily as the candidate for position on the firing line. Otherwise, his patriotism is decidedly off color.

Sticking on the Job

We have said that there are those who must stick to their present jobs, but we have used up most of our space talking to those who must be ready to change. Just a few suggestions, then, to indicate the fields which should not be abandoned without the most serious consideration of every factor. The most obvious of these, of course, is that of the gasoline engine. This has been called the war of science, of chemistry, of machinery, of supplies; with equal truth it may be dubbed the war of the internal combustion engine. These engines must be produced on a vast scale; they must be carefully differentiated according to ultimate use, then standardized for that use. Our existing resources for doing this work are on such a solid foundation that it would be folly to take the work out of the hands in which it now rests; so every engineer who is now in this field will be of more value in his present position than in any other which he could possibly find. Another major field of operations for the mechanical engineer is that of ship building. In connection with naval and civil work alike it is evident enough that he has busy days before him, and that an intolerable state of affairs would follow if he were to drop that work for other.

Of equal if not actually greater importance is the manufacture of machine tools. This is a basic industry; the making of all metal goods, without exception, depends upon it. Whether a machine or tool designer be working in an automobile factory or a shipyard, designing the special apparatus needed for and made in these establishments, or whether he be employed by one of our large commercial makers of standard machines and tools, his present services cannot be dispensed with. A position rather analogous is held by the man in charge of the mechanical details of mining and smelting. The supply of raw materials ranks with the supply of tools as an essential of all industries.

In a later article addressed to the mining engineer it is hoped to bring out the relative importance of the various metals; for the present the mechanical engineer engaged in metal production must question his own general knowledge of the extent to which his output counts in the war. A similar remark applies to the mechanical engineer whose field of action we have not specifically mentioned. If he will weigh every consideration honestly and intelligently, he will be able to make a reasonably accurate judgment of the comparative value of his present occupation and any other which presents itself to his attention. But above all things, he must not enlist for active service in Army or Navy.

THE mechanical engineer probably exceeds in numbers any of his professional colleagues; and the coming of war certainly expands his activities far more than it does those of any other technical man. In this field, then, we may look for the most serious shortage of men.

Fortunately, the mechanical engineering structure rests upon a very solid sub-stratum of skilled labor. The number of competent mechanics, foremen, and other near engineers who, with a bit of advice and assistance, are capable of assuming a share of the mechanical engineer's load, is very large. As our engineering needs in this field develop, we must therefore be prepared to institute a sort of progressive dilution of our whole mechanical man-power, moving the best men in each grade up a peg or two, and filling in at the bottom with untrained men. In this connection the next article of the series, addressed to the mechanic and skilled worker in general, will be of special interest.

The mechanical engineer, if engaged in the making of internal combustion engines, ships, machines and tools for metal working, or the production of raw metal, is needed right where he is. In other cases, he must consult his own judgment as to whether he shall enter Government service—but never as an enlisted man, always as an engineer.

—EDITOR.

The Technology of the Washroom

Why Should Laundry Work Be Done at Home?

THE laundrymen of this country are awakening to the dignity of their profession. It is dawning upon them that the work done in their washrooms is chemistry. They are commencing to ask questions. They wish to know whether a shirt washed at home, or by hand, really suffers less injury than one washed in the power laundry. Why should not the laundry be able to turn out as satisfactory a product as the washerwoman? Is there any difference in the washing materials used, or in the handling of the linen, that cannot be done just as well by the machine process? Why does soap cleanse? These are all very pertinent questions and it is most encouraging to find men asking them, for the word, "why" is really the threshold of discovery and success.

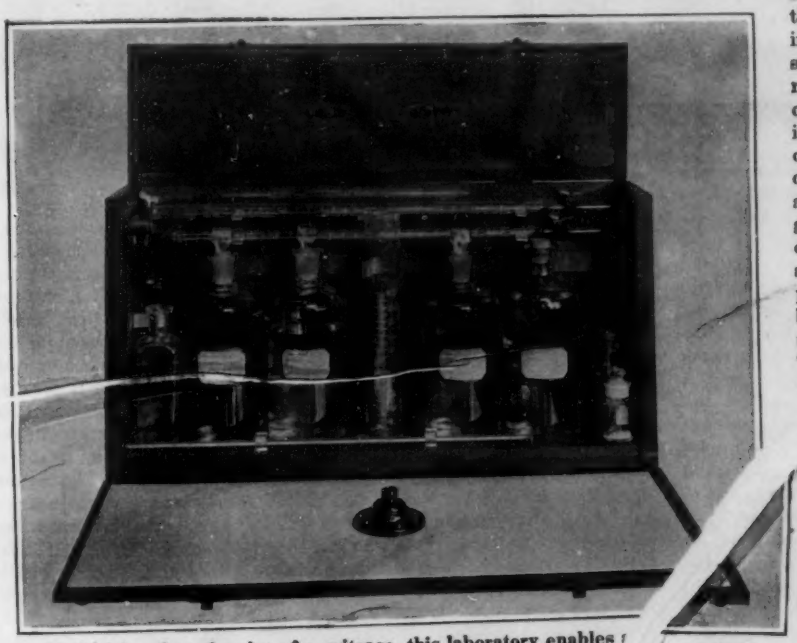
As a matter of fact, the exact action of soap has been studied for many years. Theories that have obtained for the past century have recently undergone a change, and yet there is no completely satisfactory explanation of the detergent action of soap. It used to be thought that water decomposes soap, producing caustic soda and fatty acid, and that thereafter the caustic soda reacts with the greasy film that causes dirt to adhere to a surface, saponifying the grease and giving rise to compounds that go into solution and are washed away. This would seem to indicate that it is an advantage to have soap decomposed by water. Now, however, it is shown that decomposition has a harmful effect. It is true that soap is decomposed by water, producing a very small amount of caustic soda and free fatty acid, but there is no more reason for the caustic soda to react on the greasy film of dirt than upon the fatty acid. Furthermore, all dirt is not greasy.

The latest explanation of the detergent action of soap is a physical rather than a chemical one. There is a certain physical property known as "surface tension." This it is that causes water to form in drops on a greasy surface instead of spreading out over it in a continuous film. The higher the surface tension, the larger the drops. The size of the drop, therefore, serves as a measure of the surface tension of a liquid. Soap solutions possess the lowest surface tension of all liquids.

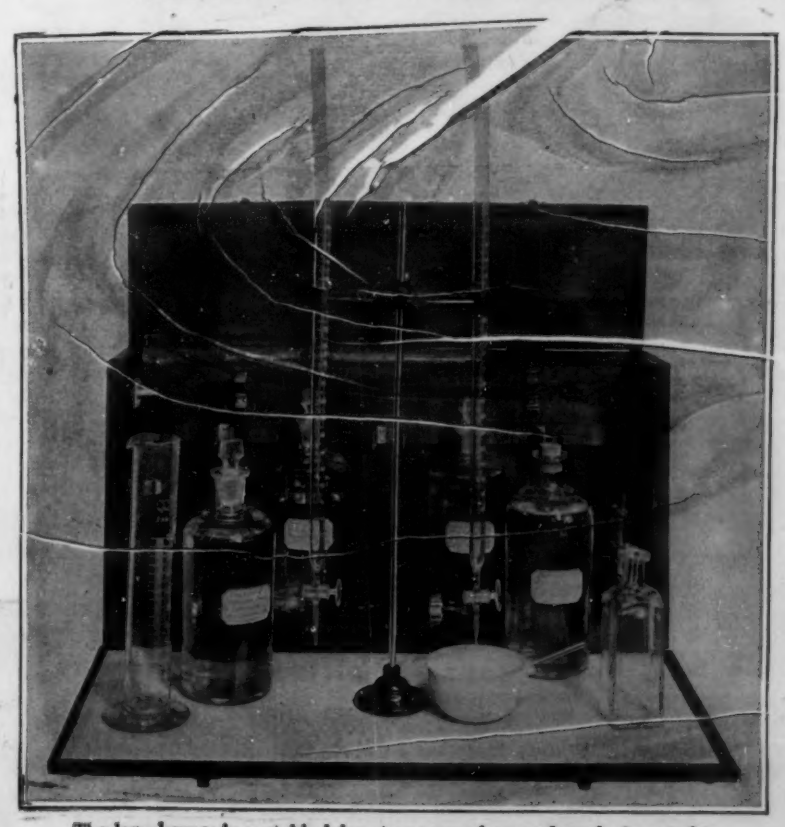
The surface tension has a great deal to do with the ability of a liquid to form an emulsion with another liquid or substance. If we pour kerosene in water and shake them together, the oil will be broken up into drops in the water. But this will not be a permanent emulsion; for on allowing the mixture to stand, the oil will separate from the water. Even if we add an alkali to the mixture, we shall not have a permanent emulsion; but if a free fatty acid is dissolved in the kerosene, the water and alkali will mix with it and form a permanent emulsion. It is the action of the alkali on the free fatty acid that gives us the emulsifying power of soap, and the value of the soap as a detergent can be measured by counting the number of drops that will be found under certain conditions by a given quantity of the solution. The soap brings the water into intimate contact with all parts of the article that is to be cleansed, enabling it to form an emulsion of the dirt, so that the latter may be carried off by the water.

Most of our early chemical discoveries were accidental. No doubt, it was discovered by chance that a good detergent could be produced by boiling wood ashes and oil. The earlier soaps were made in a very crude way, of fats and wood ashes that contained a large excess of free alkali. Later a form of caustic soda was substituted for the potash, but this soap was very hard on fabrics. It was discovered that the alkali was responsible to a large extent for the destruction of articles that were cleansed and the conclusion was reached that a soap in which there was no free alkali would be an ideal detergent. Such soaps were made and proved to be less destructive, but at the same time they were less effective as cleansers. Now we find that we have to add free alkalis to our soap solutions; in other words we have come back to the detergent whose composition was discovered by chance. But we know now exactly what is required of these alkalis and just what the various alkalis will do. In this way we can eliminate harmful results. We know why the three common alkalis, soda ash, borax and tri-sodium phosphate in our washing solutions along with the soap are desirable, even when we have soft water to begin with. It is to keep the water from decomposing the soap.

This is but an illustration of the necessity of obtaining exact scientific information about the very commonplaces of daily life, and it is most encouraging to find laundrymen themselves appreciating the value of such information. Not long ago the Allegheny County Laundrymen's Exchange established a fellowship at the Mellon Institute of Industrial Research, University of Pittsburgh, to investigate the problems of the laundryman and to improve the technology of laundry work so that the power laundry would be placed above competition with hand work. Mr. H. G. Elledge, the Fellow in charge of this research work, has already proved the value of such an investigation, and the fellowship is now being supported by the Laundry-owner's National Association.



Packed in a box the size of a suitcase, this laboratory enables the untrained laundryman to test the quality of his laundry materials



The laundryman's portable laboratory opened up and ready for service

It is of the highest importance that the laundryman should know just what materials he is using, but it is seldom that a laundryman can afford to pay the cost of having an expert chemist examine his supplies and purchases. Mr. Elledge, however, has come to the rescue by developing a very simple chemical testing laboratory, which is portable and may be packed up in a case of the size of the ordinary suitcase. The directions which accompany this portable laboratory are so simple that the laundryman may become his own chemist, or as Mr. Elledge prefers to put it, his own assayist. It enables the laundryman to guard against possible misrepresentations of laundry materials by merchants.

The accompanying photographs illustrate this laundryman's assay outfit. It contains all the apparatus and chemical solutions needed to perform the tests for the hardness of water, for the determination of the available chlorine in bleaching materials, for the testing of soda ash, caustic soda, or washing sodas, and for the determination of the total alkalinity of sodium oxide, and for the determination of the strength of acids. Ingenious testing processes have been contrived to bring the work within the capabilities of an untrained man. For instance, in the test of bleaches iodized strips of starched collar pieces are cut from a clean starched collar and dipped in a solution of potassium iodide. Then in order to test the available chlorine in electrolytic bleach, a solution of sodium arsenite is added to a measured amount of the bleach and by means of a glass rod, a drop of the mixture is placed on one of the iodized collar strips. If a considerable amount of available chlorine is present the strip will be turned a dark blue color; more arsenite solution is added until no color is produced on the test strip. The quantity of arsenite solution added to produce this result gives a measure of the strength of the bleach liquor.

The principal object of the Laundry Fellowship is to increase the efficiency of laundry work and make it superior, not only in the matter of cleansing clothes, but also in the preservation of fabrics. Laundrymen realize that they must combat the idea that home washing is not as hard on clothing as the power laundry. They hope the time will come when home washing will be as uncommon as home spinning and weaving. Certainly by intelligent use of materials in the hands of professional laundrymen, it should be possible to produce better work than is within the power of the ignorant washerwoman.

Mr. Elledge has tested the strength of linen fabrics washed in the regular power laundry machinery and finds that the loss of strength amounts to eighteen-hundredths of one per cent per hour. He has also shown that the soda ash produces less loss of strength than ordinary soap solution without any carbonate alkali. But the soap and soda together produce less than one half the loss of the two solutions separately when the concentration of the combined solution is six ounces and 0.8 pounds of soda ash in ten gallons of water. When, however, concentration of soap and soda is low so as to give what is commonly known as "running suds," a marked effect on the tensile strength of the goods is produced. The fabrics under such conditions lose three times as much of their original strength as they do with the more copious suds. This is because thick suds cushion the tumbling of the goods.

In order to compare home washing with power laundering, a lot of a dozen handkerchiefs was uniformly soiled with soot. Six were sent to the power laundry and six were laundered by a reliable washerwoman. The loss of strength, after each set had been laundered six times, was practically the same in each case.

Exposure to the air when drying affects the strength of fabrics. A handkerchief was exposed on the roof of the building for 23 days last July. In this period there were 184.8 hours of sunshine and after the treatment, the handkerchief showed a loss of 60 per cent of its original strength. Another handkerchief dipped in distilled water and hung up without wringing in the laboratory to dry showed a loss of 4.35 per cent after the operation was repeated 18 times, that is one quarter of one per cent for each drying.

There is still a great deal to be learned about laundry-work. So far, Mr. Elledge's experiments and tests show that the harmful effect of the principal reagents used in the laundry, namely, soap and soda ash, are negligible. And the usual power laundry process is at least no more harmful to the tensile strength of linen (and by natural deduction of cotton) than is the method employed by the washerwoman.

Generals of Shadowland Warfare

How Battle Scenes and Mob Scenes are Handled by the Motion Picture Director

By Austin C. Lescarboura

WITH all outdoors for its stage and with nature as the scene painter, the motion picture will always possess a tremendous advantage over the legitimate drama which must necessarily confine even its most grandiose efforts to a comparatively limited stage and artificial scenery. Yet it would not be true to claim every advantage for the motion picture; indeed, its disadvantages are often evident and at times troublesome, although constant improvements are doing much to eliminate the better part of them. Nor would it be true to claim that the natural scenery and the unlimited stage facilities have played the most important rôle in making the shadow-play a success; for quite apart from these features the present photoplay could still hold its own. But, nevertheless, the stirring scenes of thousands of soldiers engaged in realistic battle; of thousands of strikers menacing an industrial plant; of thousands of men, women and children marching on the palace of the emperor in order to demand his abdication; of thousands of people fleeing from the oncoming streams of molten lava pouring from a volcano in full eruption—all of these belong, and are only possible, in the realm of shadowland. Realizing this full well, the motion picture director works largely in the open, and when a story justifies the expense and trouble, he does not hesitate to gather an army of players and make use of a natural stage whose dimensions are measured not in feet but in miles.

Big scenes are rather the exception than the rule in motion picture productions, for they are exceedingly costly. So the director's efforts are usually confined to the handling of a small number of players indoors and outdoors, with an occasional mob scene.

Selecting and Preparing an Outdoor Stage

A motion picture director does not build or paint his outdoor scenery—he selects it. Not so long ago the director himself did the selecting, often employing an automobile for the purpose of searching far and wide for natural stages or "locations" best suited to the production in hand. But with the advent of efficiency methods in the industry, there has come a new order of things: the tendency today is to break up the work into different and distinct classes, each of which is handled by a specialist. Thus the director of a large producing organization no longer attends to the preparation and revision of the film story or scenario—a scenario writer or scenario editor attends to that; he no longer attends to the selection of his cast—a cast director attends to that; he no longer supervises the erection of sets—a technical director or art director attends to that; and he no longer searches for his locations—the location man or location director attends to that. So the director of today, in the broader sense, is relieved of all the details not directly concerned with the action of the film story, although he still passes upon these details in the form of finished work.

But the fact is, that there is no general definition for the motion picture director, since each individual places a different interpretation upon the duties of that modern professional, as witness those who prefer to write and to revise their own scenarios, and those who prefer to hunt their locations without aid. Considered as a class, however, the director is fast coming to recognize the advantages of the new order of things, and is unburdening these details on others so as better to concentrate his attention on the action of the production.

Locations, then, whether selected by the director or the location man, are considered because of their topography, vegetation, and other features. In the more progressive studios the location director is intimately familiar with the country within a wide radius of the home studio. As often as not his findings are photographed and filed under various classifications so that a director can consult the files for any location he may be after, and if the photographs and data are encouraging, he can take a flying trip to the site to pass upon its availability. Aside from natural scenery, the location man keeps a sharp lookout for architectural backgrounds, for it is often possible to secure a suitable bit of architecture which, when used as a background of a picture, makes for the desired "atmosphere," be it of another land or another time.

The accessibility of a location is usually of little consequence, since the producer has ample facilities of his own to move the company of players to the selected site. If it is within reasonable distance, the actors are carried out to the location in automobiles and motor buses; otherwise, the usual means of transportation are resorted to.

Depending on the nature of the film play, the outdoor stage must be more or less prepared for the actors. Sometimes it is necessary to build elaborate structures, such as entire villages or forts or public buildings, as the case may be, and anywhere from a few weeks to a year may be spent in the erection of these sets. Battlefields, on the other hand, also require considerable time for the preparation of the ground, and a few weeks are usually required to dig the trenches, build up sand-bag ramparts, construct bomb-proofs and string barbed-wire entanglements under the supervision of military experts, and to erect the camera platforms.

The installation of a telephone system is often the most interesting part of the work. In order that the action of various groups of actors may be synchronized and at all times be under the control of the director, a telephone system connects the various parts of the field with the director and the cameramen. In the handling of big battle and mob scenes the telephone is practically indispensable, although other methods of issuing orders are employed by some directors.

Another feature of the work of preparation is the planting of mines to simulate

Generals of shadowland warfare and how they carry on their work with telephone systems and with megaphones

Upper view: Cecil DeMille wearing a telephone instrument while directing a battle scene in the Lasky production "Joan the Woman." *At the left:* Filming the cabaret scene in the Vitagraph production "The Girl Philippa." Shells are seen exploding on the walls of this scene in the film production, the effect being secured by the use of electrically fired mines. *At the right:* Director and cameraman taking photographs of the house-to-house fighting in the Vitagraph production "The Girl Philippa." Exciting struggles took place on the balcony at the right.

Generals of motion picture warfare on the field of battle, "somewhere in Staten Island, N. Y."

At the left: Director J. Stewart Blackton, assisted by Director Earle, handling one of the battle scenes in "Womanhood, the Glory of a Nation," in which over one thousand soldiers took part. *At the right:* "Enemy" troops awaiting the order to attack. Note the tents in the background. Three weeks were required to prepare the ground and one week for actual filming in the production of these battle scenes. Mines were planted throughout the field and electrically fired at the propitious moment, their positions being indicated on a chart.

land mines and detonating shells. Some companies employ a specialist in this line of work—a man who has had wide experience in the handling of pyrotechnics. Following the instructions of the director, the bomb man plants his mines at specified points throughout the field, usually placing an inconspicuous stake above each mine and charting the arrangement of the mines for reference purposes. The mines are electrically connected with firing stations to facilitate their explosion when the moment arrives.

In every way the location is prepared before the director and his followers arrive, for in productions where the personnel mounts up into the hundreds or thousands it is obviously essential that everything should be in readiness to film the scenes without delay. With such a large gathering of players drawing anywhere from two dollars to five dollars per day, an oversight in the preparations may cause a serious delay and an ensuing expense of hundreds or thousands of dollars. So it is only after the field has been thoroughly prepared that the director is ready to take up his work.

The Commander-in-Chief and General Staff of a Motion-Picture Battle

Perched on top of a wooden structure which towers high above the outdoor stage, the director and his entourage usually enjoy an unobstructed view of the field. Depending upon the magnitude of the production, there are under his immediate command two or more cameramen with their cameras, and a number of assistant directors or lieutenants stationed on the elevated platform and scattered at vantage points about the field. Obviously, the handling of so many people cannot be undertaken by one man alone, hence the practice is to assign the assistant directors to various groups of actors who, while immediately under the direction of these lieutenants, are really under the general direction of the director-in-chief.

In issuing orders to nearby groups of actors, such as in close-up scenes, the director and his assistants employ megaphones; but in handling actors a few hundred feet away this means becomes totally inadequate. It is then that the wig-wag method of signaling comes into play, and proves most effective since the actors themselves can read simple signals if necessary. Aside from the wig-wag method, the telephone system is largely employed. The sub-directors, stationed out-of-sight at various points in the open-air stage, are in touch with the director by a line of series-connected telephones. Thus when the director issues a command all the directors hear it, but since he specifies the particular person the message is intended for, no trouble is experienced. Isolated cameramen, too, are telephonically connected with the director, and receive instructions when to take pictures and when to stop.

A camera platform used by Director Kirkwood in photographing a village scene.

The main battery of cameras is usually situated near the director so as to get a clear sweep of the stage, but at various points hidden cameras are used to secure glimpses of interesting action. In the storming of a fortress, for instance, a battery of cameras is used to get the entire scene, while a hidden camera may be used to record the struggle in the moat, another for the fighting on the parapet, another for the struggle at the portcullis. True, these scenes might be taken by the same camera, one after another, but the actors would be engaged for a longer time and at a higher expense, and what is more, the action would not be connected together nearly so well as it must necessarily be by the present method of employing a large number of cameras simultaneously. And in no little degree the skill of the director is shown by his ability to issue orders to the various cameramen, who "shoot" or rest as they are instructed.

One of the earlier American productions on a large scale was the Biograph "Judith of Bethulia," produced in California some three years ago under the direction of D. W. Griffith. In this production over 1,000 actors and 300 horsemen were employed. Many expensive sceneries had to be constructed, foremost among them being a replica of the ancient city of Bethulia, the mammoth wall that protected the ancient city, a faithful reproduction of the army camps with all their barbaric splendor and dances, and chariots, battering rams, scaling ladders, archers' towers, and many other weapons of the period.

(Continued on page 456)

A glimpse "behind the scenes" during the production of a gigantic motion picture mob scene

At the left: Director Ince handling a scene in the production "Civilization." In order to secure rain scenes, water was pumped from the ocean and sprayed on the players as shown. An umbrella was used to shield the camera. *At the right:* A sub-director handling a mob in front of the palace used in "Civilization." Note the camera platform at the left.

The Heavens In May, 1917

The Tiniest Member of Jupiter's Large Family of Satellites

By Prof. Henry Norris Russell, Ph.D.

PROBABLY the most interesting astronomical news of the past month relates to the tiny ninth satellite of Jupiter, which was discovered by Dr. Nicholson at the Lick Observatory in 1914. This minute object, which has never been *seen* with even the largest telescopes, but can be photographed with a few very powerful instruments, was rediscovered at the Lick Observatory toward the end of 1915, with the aid of the provisional orbit calculated by the discoverer from the observations of the previous year. These observations made it possible to determine the orbit more accurately, and with the aid of these new elements, the satellite was found in 1916 upon photographs taken at Mount Wilson by Dr. Shapley, only about two minutes of arc from one predicted position. This discrepancy shows that the form of the satellite's orbit is not yet precisely known, but is small enough to make it clear that there can be no doubt about its general size, shape and character.

The newly calculated elements show that the eighth and ninth satellites of Jupiter are in many respects similar, forming a "pair of horns" just as the sixth and seventh do. But the two pairs of satellites are very unlike one another. The sixth and seventh move around the planet "directly," that is, in the same sense as that of the motion of the four large satellites, or of the planet's rotation and orbital motion. Their periods are 250 and 260 days, and their mean distances from the planet 7,114,000 and 7,292,000 miles, respectively. The actual distances vary on either side of the average by 1,100,000 miles for the sixth satellite and 1,510,000 for the seventh, the eccentricities of these orbits being 0.15 and 0.20. Both orbits are inclined about 28° to the plane of the planet's orbit, but in different directions, so that these planes make an angle of nearly 30° with one another.

The eighth and ninth satellites, on the other hand, are both in retrograde motion, revolving about the planet in the opposite direction to all the others. Their periods are very long, 739 days in the case of the eighth, and about 745 in that of the ninth, so that it takes either one two full years to complete a circuit about the planet. As might be inferred from the approximate equality of these periods, their mean distances are also nearly the same, 14,600,000, and 15,000,000 miles. Both have highly eccentric orbits, so that they are almost twice as remote from the planet at their farthest as at their nearest; and the planes of their orbits are inclined about 32° and 24° to that of the planet's orbit, and about 10° to one another. The most remarkable things about them, however, (unless perhaps their retrograde motions) are the enormous alterations in their orbits, even from one revolution to the next, caused by the attraction of the sun.

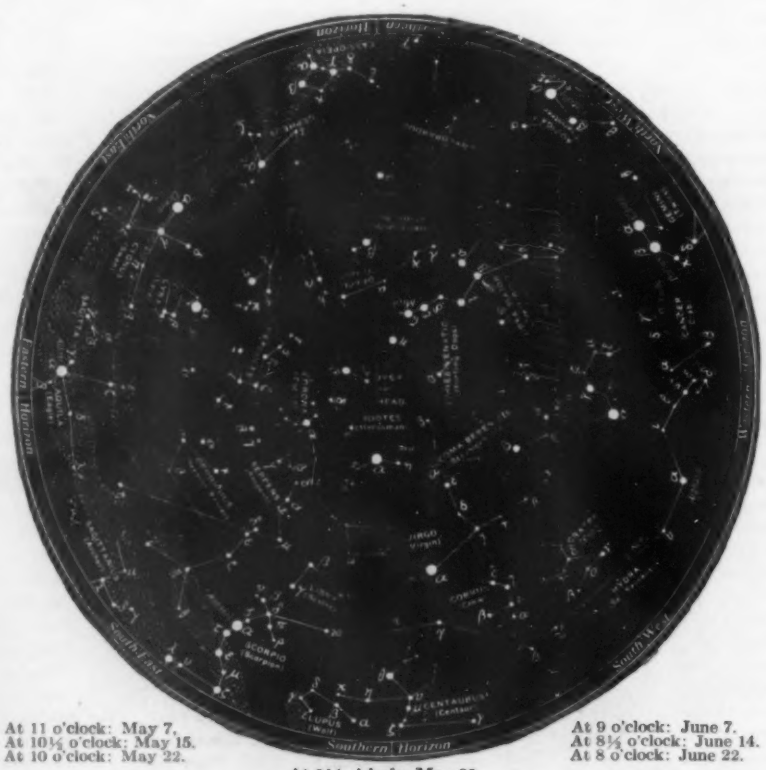
Thus, according to the calculations of Crommelin, the distances of the eighth satellite from the planet at four successive times of closest approach were 9,300,000, 8,400,000, 8,400,000 and 10,300,000 miles, and its successive maximum distances 20,000,000, 21,100,000, 20,200,000 and 19,100,000 miles. If it had not been for the sun's attraction, the satellite would have pursued the same track every time, and the four greatest or least distances would all have been equal to one another. In similar fashion Nicholson's computations show that the ninth satellite, when at its greatest distance from the planet in 1915, was 17,600,000 miles from it, early in 1916 it reached a minimum distance of 11,400,000 miles, but on returning to its greatest distance, early in 1917 it found itself to be 20,000,000 miles from Jupiter, more than two million miles farther away than the greatest distance reached on the previous round.

All the other elements of the orbits likewise change rapidly from one revolution to another, so that the actual track of the satellite about the planet is a very complicated curve, by no means re-entrant, and far from lying all in one plane, so that, to give a really satisfactory idea of its motion, it would be necessary to construct a wire model showing the intricate relations of its successive coils. It need hardly be said that the computation of such motions is very difficult and laborious, nor should it be more necessary to add that, for this very reason, they appear especially attractive to the few astronomers whose natural gifts predispose them to the investigation of such problems.

The backward direction of motion of these remote satellites, and the remarkable changes in their orbits, raise acutely the old question: Have these bodies always been circulating about Jupiter, as his satellite, or can they possibly be "captured" asteroids, which, straying too near the mighty planet, have been deflected by its attraction, and ended by forsaking the sun to revolve about him?

For the sixth and seventh satellites, which lie nearer the planet, the question is capable of definite answer. A simple mathematical test shows that so long as nothing but the attraction of Jupiter and of the sun works upon these satellites, they can never leave his neighborhood, but will continue indefinitely to circulate about him in the future, and presumably have done so for an indefinitely long time in the past.

For the eighth and ninth satellite, however, this criterion indicates that it cannot be said with certainity that either of them has always been a satellite. It is *possible* in the case of the eighth (and probably too, in that of the ninth, for which the necessary calculations have not been completed), that at some time in the past it may have been captured by Jupiter's attraction, and that, similarly, it may at some time be carried off again by the influence of the sun, and become an independent planet. But, to show that such an event is possible is far from proving that it is probable, much less that it actually occurred.



At 11 o'clock: May 7.
At 10½ o'clock: May 15.
At 10 o'clock: May 22.

At 9 o'clock: June 7.
At 8½ o'clock: June 14.
At 8 o'clock: June 22.

At 9½ o'clock: May 30

NIGHT SKY: MAY AND JUNE

Moulton has shown that a satellite of Jupiter with a period of two years would certainly remain a satellite indefinitely, and never leave the planet if Jupiter's orbit were circular, the orbit of the satellite nearly circular, and its motion retrograde. Though the orbit of Jupiter is not quite circular, and those of the eighth and ninth satellites are far from being so, it is probable that Moulton's conclusion applies to them too, and that they are permanent members of the planet's system. But Moulton has also shown that if these satellites moved around Jupiter in the same direction as the inner ones, and at their present distances, they would suffer far greater perturbations than they do now, and would very probably be driven away before long into independent orbits about the sun. Their retrograde motion may therefore be the very reason why they have remained near the planet, and come to be counted as permanent members of the Jovian family of satellites.

The Heavens

The warm nights of spring afford a good opportunity to begin aquaintance with the constellations. Our map will be a valuable aid to the novice, when once he realizes that it represents the sky, as it would be seen by a man lying on his back, with his feet to the southward, and looking straight up. At the hours of the night stated below the map, on the various dates, he will see the stars just as indicated thereon. Looking straight up, the most conspicuous object is the great red star Arcturus, not quite overhead, but a little to the southward. About as far from the Zenith (the point directly overhead) but on the opposite side, is the tail of the Great Bear, or as we are perhaps more likely to know it, the handle of the Great Dipper, whose curve, carried southward, leads us back to Arcturus. Carrying the same curve downward, we come to a bright star, a little west of south and fairly high up. This is Spica, the principal star of Virgo, whose other stars lie to the westward, and can be made out with the aid of the map. To the west of Spica is the little quadrilateral of Corvus, and below it are some of the northern stars of Centaurus. The southern Corvus may be seen at this season, low on the southern horizon, from points in southern Florida or Texas. The conspicuous group rising in the southeast is Scorpio, whose brightest star, Antares, is brilliantly red, and is flanked by a fainter white one on either side. Due east, and very low, is another bright star, Altair, which has a very similar pair of companions, but may be distinguished by its white color, as well as its different position in the sky. In the northeast is Cygnus, a great cross with its longest line lying in the Milky Way and its arms flung across it—and above this is the brilliant bluish-white star Vega, in Lyra. Between Vega and Arcturus are the "Keystone" in Hercules and the semicircle of Corona, both easy to recognize. Cassiopeia is very low in the north, while the Little Dipper (Ursa Minor) and the Dragon are above the Pole star. The two bright stars of Gemini, Castor and Pollux, are low in the northwest, with the still brighter planet Saturn near them on the left. The sickle of Leo, now due west, and the long line of Hydra, low in the southwest, complete the list of the more prominent and better known constellations.

The Planets

Mercury is an evening star at the beginning of the month, setting rather more than an hour later than the sun; but he soon disappears from sight, passes between us and the sun on the 16th, narrowly escaping a transit across the sun's face, and after this is a morning star, though not easily seen till next month. Venus is just past conjunction, on the far side of the sun, and invisible, though theoretically an evening star; Mars is a morning star, rising at about 4.15 A. M. in the middle of the month, and too deep in the dawn to be easily seen. Jupiter is in conjunction with the sun on the 8th, and is invisible. Saturn is an evening star in Gemini, setting at 11.30 P. M. in the middle of the month, and is the only one of the brighter planets that is at all easily visible.

Uranus is a morning star in Capricornus, rising about 1 A. M., and just observable before dawn. Neptune is in Cancer, setting about 11.30 P. M., and is observable (telescopically) after dark.

The Moon is full at 10 P. M. on May 6th, in her last quarter at 9 P. M. on the 13th, new at 8 P. M. on the 20th, and in her first quarter at 7 P. M. on the 28th. She is nearest the earth on the 13th, and farthest away on the 27th. As she circles about the heavens, she passes near Uranus on the 14th, Mars on the 19th, Jupiter and Mercury on the 20th, Venus on the 21st, and Saturn and Neptune on the 25th.

Mellish's Comet, whose discovery was reported last month, turns out to have had a small perihelion distance of only 15,000,000 miles. It came to perihelion on April 12th, and is now visible only in the southern hemisphere. Could it have been seen on a dark sky, it might have been a conspicuous object, but moonlight and twilight combined to prevent this.

Princeton University Observatory.
April 23rd, 1917.

A New Map of the Sunspot Spectrum

IN 1907 the Mount Wilson Observatory prepared and distributed a map of the sunspot spectrum on a scale of two millimeters to the angström. Thanks to some fine photographs of the spectrum of a large spot recently taken by Mr. Ellerman with the 75-foot spectograph, the observatory has been able to prepare a new map, on a scale of one centimeter to the angström, which is sufficient to show the chief phenomena of the Zeeman effect, including certain interesting anomalies. The map at present covers only the region from wave-length 6,000 to wave-length 6,450, but will be extended as soon as suitable photographs can be obtained of other regions.

"Lady Bug, Lady Bug, Fly Away Home"

A CONVENTION of lady bugs is as rare as it is interesting. The accompanying photograph shows a small section of a gathering of these beautiful, brown-enameled little creatures that gathered by the tens of thousands on the top of Genessee Mountain, the highest point in the Denver Mountain Park region.

The lady bugs live upon smaller insects, and such a gathering as the one referred to is a sure indication that infinitesimal parasites are destroying vegetation. For this reason horticulturists and gardeners prize them very highly.

The altitude at which this convention was photographed is 8,270 feet. The beetles covered the rocks and the stems and leaves of native shrubs over an area of one hundred square feet.

A convention of lady bugs

Venomous Snakes at Close Range

AS one of the pictures herewith shown indicates, a live rattlesnake can be held in the hand without danger, if any venturesome individual has the nerve to carry out the feat. Of course, it is possible to photograph a snake recently deceased in such a way that it looks alive and wicked, but this is not that kind of a picture. The particular rattler shown in the photograph was alive and alert and there was no trickery about his portrait.

In the course of a recent evening's entertainment, the proprietor of the hands which appear here electrified a Philadelphia audience by releasing the rattlesnake from a canvas bag and holding it in his hand. First he dropped the creature to the carpeted floor. The rattler curled up in striking attitude, but remained motionless except for the constant whirr of his rattle and the darting in and out of the forked tongue. Warning the spectators to keep perfectly quiet, the exhibitor slowly moved his hand toward the snake from behind and gently elevated first the tail, then the entire snake, upon the palm of his hand, the snake showing no anger or resentment at the liberty taken.

What would have happened had the reptile shown an ugly disposition may be guessed. The owner says he could drop it and kill it before it could turn and strike him. He claims to be quite safe in doing this daring stunt, so long as he is behind the snake, although he admits that on one occasion a snake doubled back his head and struck in that unusual way.

The fangs and tongue of a rattler

Rattler's head stripped to show white poison sac leading to fang in upper jaw

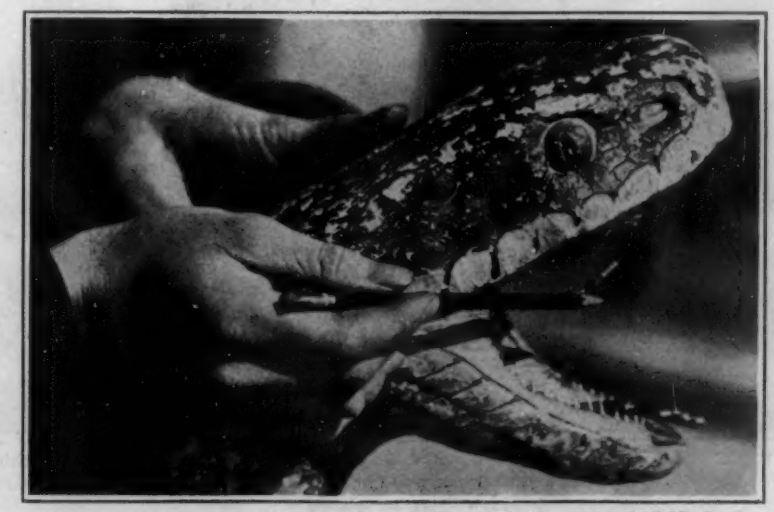
But the man who has chosen this field of investigation has not escaped without injury from the snakes. He has been bitten many times by non-poisonous varieties, and thinks nothing of this. But he has also been bitten both by rattlers and copperheads, and he carries the scars of these encounters on his hands as proof. When on a snake hunting expedition he always carries with him an outfit of permanganate, which he says is a perfect antidote for the snake poison. He illustrates on this page his method of treating his own wounds when bitten by a venomous snake.

Presuming that the bite is on the hand or arm, as is most likely the case, he fastens a tourniquet above the wound, tieing it with his teeth in the way shown, and then cuts around the puncture and applies the permanganate to the spot where the poison has entered. If applied at once he asserts that this is a sure remedy; but quickness is essential.

Quickness in fact is necessary at any stage of the snake hunting game, if satisfactory results are to be obtained Snakes move fast and where the hiding is good they are not easy to follow. They are best sought in disused quarries and in railroad cuttings, and are caught by pinning their necks with a stick. A captured snake may be lifted by the back of the neck, between thumb and forefinger, held tightly so that the head is imprisoned, and dropped into a bag.

Snakes have to be sought for. They are not partial to human society and unless the unwary traveler through the woods accidentally treads upon one, he is not likely to be troubled by the snake's attention. The snake will escape if he possibly can, and as he will do so noiselessly the person not familiar with the habits of the reptiles will never know how near he has been to possible death from the bite of a venomous snake. This expert claims that, by hunting for them, he will find scores of snakes within a few feet of paths that are trodden by wayfarers who could scarcely be made to believe that there was a snake within a mile. The venomous kind he kills or captures. The fewer of these left, the better. And with a buggy whip he says that he is equipped for a fight with any snake he is likely to encounter. But the harmless snakes he leaves, unless he wants to take a specimen home with him. These are worth money to the farmer, because they feed on field mice, insects, etc., that destroy his crops. Therefore, anyone who kills one of these non-poisonous snakes is doing a positive injury to the community. They should be encouraged and fostered for the good work they do on the farms. But for the rattler and the copperhead, the mocccasin and other deadly snakes, a short cut with the buggy whip is the proper conclusion.

Self-treatment for a rattlesnake's bite



The poison fang as it looks when the rattler strikes; in repose it folds back against the jaw

Future Fertilizer Supplies and Requirements

THE stoppage by the war of potash imports called attention in a startling manner to the importance of an adequate supply of fertilizer materials for the crops of the future. The proposal to erect a government plant for the manufacture of nitrates for explosives and fertilizers has kept the subject in the popular mind. It may be worth while to consider a little both the supplies of fertilizing materials likely to be available in the future and the need for the various materials containing plant foods.

With phosphates the country is well supplied. The high-grade rock of the Tennessee fields has been little more than well scratched. The smaller beds in Arkansas and Kentucky are entirely undeveloped. The Florida and South Carolina deposits have been much more largely utilized, but supplies may be expected to come from both states for a long time. And there are numerous deposits of lower-grade rock in various sections of the country.

The supply of phosphates would thus seem to be ample, even though it is likely that the demand for phosphorus will also greatly increase. Under the best system of farming there is a slow but steady draft on the soil's supply of phosphorus. Some means of replacing this loss must of necessity be employed, and except in individual and exceptional cases this means must be the commercial fertilizers. The manures produced on the farm are all low in phosphorus content and there is no way in which the farmer can add to his phosphorus supply as he can to his supply of nitrogen.

In connection with phosphorus it is necessary to secure certain other raw materials. Thus it is always advisable and often imperative to treat phosphate rock with sulfuric acid, thus making acid phosphate and reducing the phosphorus to a form soluble in water. Phosphates are abnormally high just now not because of any scarcity of phosphate rock, but because sulfuric acid is in unusual demand.

The potash situation is different. There is plenty of potash in this country, but only in such form that extraction costs make competition with the German product impossible under normal conditions. Unless improved methods of making available our own supplies can be found, we must accept higher prices or renewed dependence upon Germany.

A beginning toward a domestic supply seems to have been made by the invention of methods for utilizing the waste from cement mills, by the evaporation of the potash from some of the saline lakes of the west, and by the establishment of experimental plants for the utilization of the kelp of the Pacific seacoast. It is to be remembered, however, that as yet there is only the prospect of our independence of foreign potash. All the plans which have graduated from the experimental stage are incapable of producing more than a portion of what is needed. Many of the proposals, such as the utilization of the feldspars and related rocks of the Eastern mountains, have not even the virtue of plausibility.

Dependence upon foreign potash is made much less galling than it might be by the fact that the farmer, as a rule, can get along without potassic fertilizers much better than he can without those containing phosphorus. Under good farming the soil's supply of potash need be depleted little if at all Indeed, on most clay soils it is possible greatly to increase the supply of available potash in the soil for a long period of years by better cultivation, more frequent liming and increase of the humus-making matter in the soil. Only a small portion of the soils of the country seem to be really deficient in potash and it has been found that even here the necessity for its application can be postponed by good farming. The clay land farmer who religiously saves his manure and returns most of his straw and hay to the farm instead of selling it off, can get along without potash for many years and suffer little by so doing.

On the other hand, there will always be need for nitrogen in an inorganic form for fertilizers. The greater part of what is needed to produce our corn and wheat and fruit crops should be taken from the air by the bacteria on the roots of the leguminous plants, for these bacteria can do it much more cheaply than can any electrical process yet devised. But even the farmer who has his soil well filled with vegetable matter, and consequently well supplied with nitrogen, will find occasion at times to use some quickly available form of nitrogen to supply some unusual need of his crops or to meet the

(Concluded on page 455)

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A Tiny Turbine that Turns a Lawn Sprinkler

ONE of the neatest of the arrangements which we have seen to make the artificial watering descend upon our lawns "like the gentle rain from heaven" is that illustrated herewith. On its way from the hose to the spraying holes the water passes through a miniature turbine, to which is attached a shaft with spiral gear meshing with the teeth of a small wheel. The latter is joined centrally to the pipe through which the water flows after leaving the turbine. This pipe, pierced at regular intervals with holes, rotates upon its own axis, scattering its sprays to a distance of fifteen feet on each side. The whole outfit sets firmly upon two curved supporting plates, and may be carried from place to place while in operation, without any necessity for shutting off the water or getting drenched by a fugitive spray.

The Study and Mapping of the Atmosphere as An Aid to Airmen

NOW that the aeroplane is practically prefected, and many people are learning to fly, an effort is being made by the National Advisory Committee for Aeronautics to promote the study of the atmosphere over this continent and the adjacent waters, and have a set of accurate charts made for the benefit of our aviators. This investigation is to be known as an aerological survey.

Especially is this problem vital as it concerns our National preparedness program, now apparently well underway. This fact was brought out by a telegram read by President Alan R. Hawley, at the recent Aero Club of America banquet in New York, from Dr. Charles D. Walcott, Secretary of the Smithsonian Institution, and chairman of the executive committee of the National Advisory Committee for Aeronautics, who after expressing his regrets, advised that the assembled members urge most strongly the establishment and maintenance of aerological surveys over North America and the adjoining waters for the protection of the lives of our aviators, the safety of air craft and the furtherance of their operation.

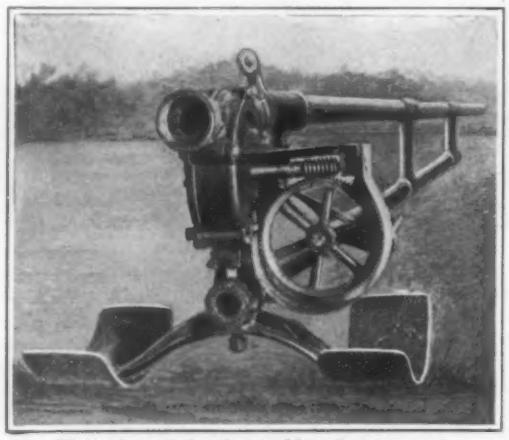
"At present," stated Dr. Walcott, "practically nothing is known of the movements of the fluid in which shortly thousands of aircraft representing millions of dollars in investment, will be floating, and, what is far more important, they will be operated by thousands of our finest specially trained young men."

Aviation is recognized as one of the prime factors, if not the initial necessity, of preparedness. During the past twelve months the National Advisory Committee for Aeronautics has been exercising every means within its power to advise and assist the aerial arms of the Government, both for land and sea operation. This committee has been able to assist in standardizing aeroplane construction to a certain extent, has met with manufacturers of aeroplanes and aeroplane motors in an effort to expedite the delivery of machines to the Government, and has been of great assistance in the solution of many other problems.

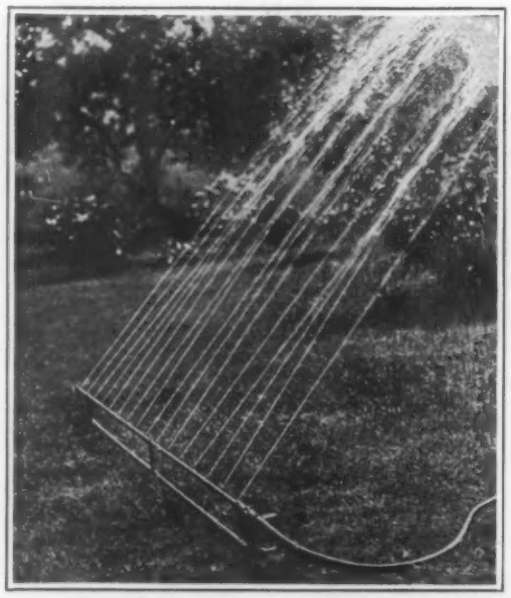
Now it proposes that earnest thought be put on the vital necessity of recording and charting the irregularities of the atmosphere so that our aviators in peace or war may have the benefit of exact information both for their own safety and as an expedient to efficient operation of aerial messenger, reconnaissance, and fighting service.

The committee believes that the time has come when aerological stations should be established and maintained, especially in conjunction with military training stations maintained now or in the future for the instruction of aviators. The plans include, through the cooperation of the Weather Bureau, the establishment of additional acrological stations for observing, measuring and investigating atmospheric phenomena in the aid of aeronautics, not only at the surface of the earth but at different elevations up to ten thousand feet or more, and mapping of the same. The functions of this system would serve aviation much as the Hydrographic Office of the Coast and Geodetic Survey advises on ocean navigation.

An estimate of appropriation of $100,000 for the establishment of special aerological stations in connection with the U. S Weather Bureau was submitted at the last session of Congress, and the matter will probably be brought to the attention of the present Congress. The National Advisory Committee for Aeronautics believes that this question should receive the backing and support of every true-hearted American.



Close view of the tiny turbine that operates the sprinkler



Oscillating sprinkler for the lawn, the streams of which are directed by a turbine drive

Periscope Mount for Machine Guns

TO add to the deadliness of the machine gun, a mount has been invented which enables the gunners to operate in complete concealment. The mount will take any machine gun used in our Army—the Benet Mercier, Colt, Lewis, Maxim and Vickers. It weighs 150 pounds and may be disassembled and carried off by five men in units not weighing over 35 pounds. It consists of a tripod stand with swivel head on which is mounted a bracket that carries the gun. By means of a worm gear the head of the mount is swivelled to train the gun upon the target. The bracket that carries the gun is hinged to the swivel head, and it may be tipped forward or to the rear by means of nuts, engaging a pair of threaded rods. These nuts are turned by a handwheel which furnishes accurate control of the elevation of the gun. The gun is not mounted directly upon the bracket, but is carried in a cradle that slides up and down the bracket under control of a nut and screw gear.

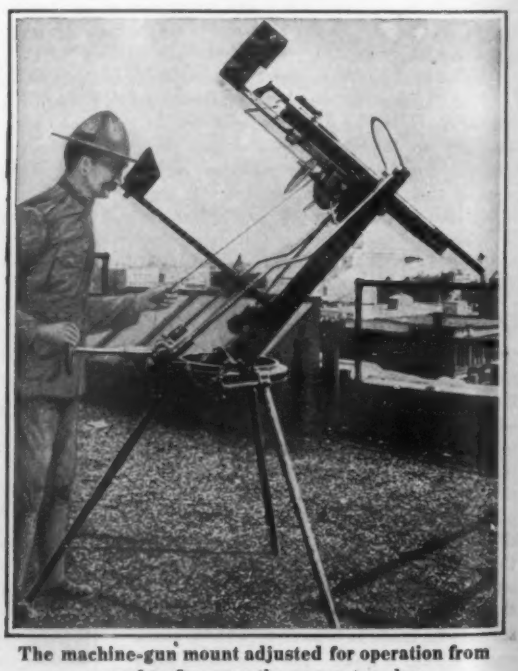
By means of a pair of mirrors the gunner can sight the piece from a position considerably below the cradle, so that he is safe from the rifle or machine-gun fire of the enemy. Our pictures show three of a number of applications of the mount. The most useful service undoubtedly is in the trench where the operator could be reached only by well directed shell-fire. In a city battle in which machine guns are posted upon roofs of houses the mount may swing forward to direct the fire over the parapet without exposing the gunner. One of the pictures shows how a lone gunner could operate in a pit against aircraft. In this case he would have to dispense with the periscopic attachment.

Agricultural Experiment Station in Venezuela

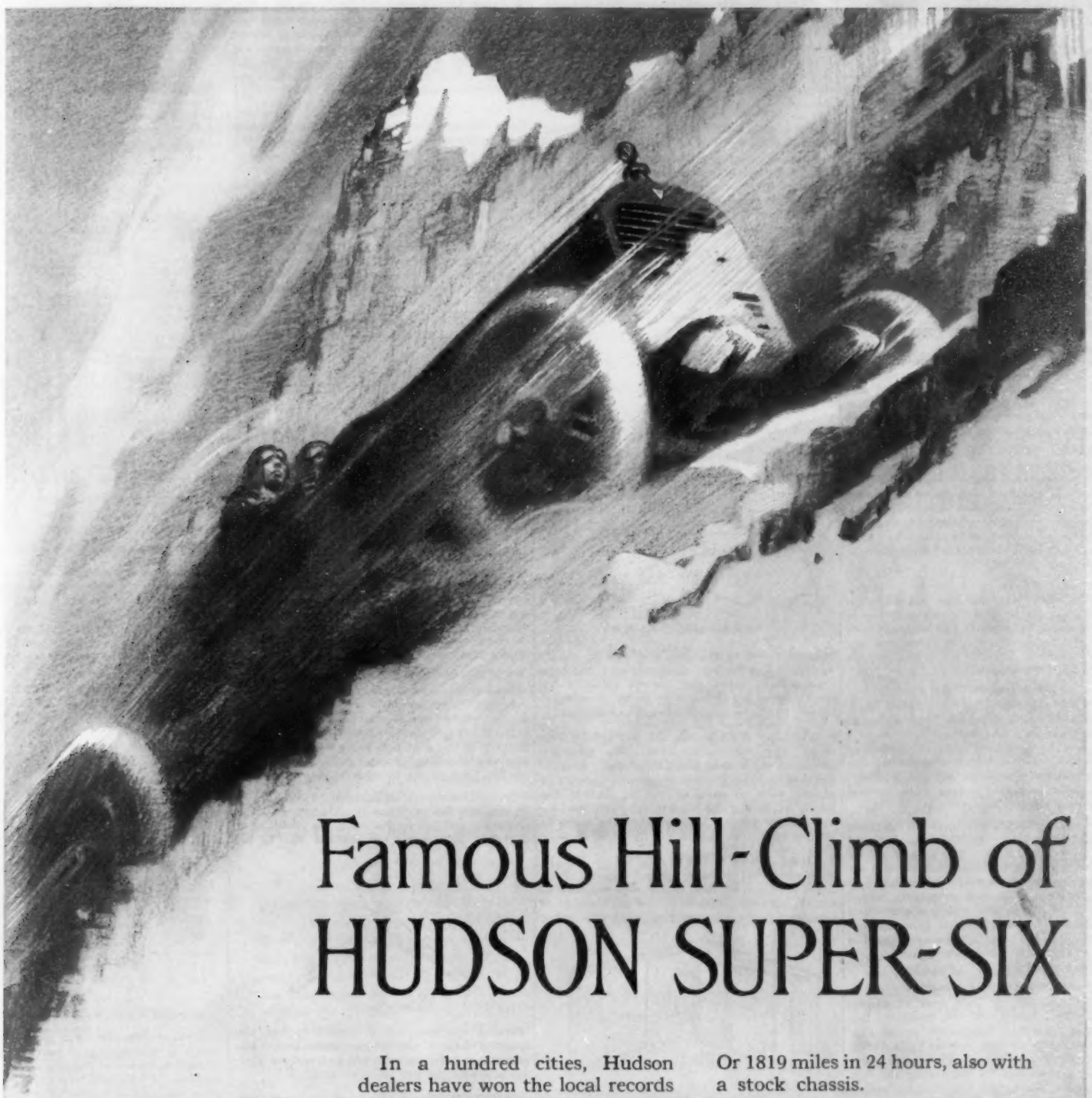
BY a decree of March 12th, 1917, the Government of Venezuela has provided for the establishment of an experiment station for agriculture and forestry, with a garden of acclimatization, to be situated near the city of Caracas. It will serve as a model for other such stations to be established in various parts of the country. The director of the new station will be Mr. H. Pittier, the well-known Swiss naturalist, formerly in charge of the Geographical and Natural History Survey of Costa Rica, and later connected with the U. S. Department of Agriculture.

Periscopic mount with which a machine gun may be operated in the trenches without exposing the gunner

The machine-gun mount used without a periscope by a gunner concealed in a pit to attack low flying aeroplanes



The machine-gun mount adjusted for operation from a roof to fire over the parapet under periscopic control



Famous Hill-Climb of HUDSON SUPER-SIX

In a hundred cities, Hudson dealers have won the local records with the Super-Six.

Not in America only. In several countries Super-Sixes have won the hill-climbing records.

But the Pike's Peak climb last September was the world's supreme test. There twenty great cars, all specially built, met for a race to "the top of the world." And the Hudson Super-Six made the best time of all.

What They Drove

The Super-Six, remember, is a small, light Six. It doesn't win by size. It won these tests just as it won all other worth-while records—by endurance.

This invention—patented by Hudson—has minimized motor friction. It thus added 80 per cent to the motor's efficiency. It nearly doubled the motor's endurance.

You don't care to climb Pike's Peak at the speed the Super-Six showed it could do. You don't care to go 102 miles per hour, as a Super-Six stock chassis has done. Or 1819 miles in 24 hours, also with a stock chassis.

But you want the car which holds those records, if you buy a great car. Not because they prove capacity, but because they prove endurance—prove that no service you will ever demand will equal its capacity.

All-Round Ruler

But the Hudson is now more than monarch in performance. It is fully as distinctive in style and beauty this year, in finish, in equipment and in luxury. It has a new gasoline saver, in the form of radiator shutters, which, through controlling the heat of the motor in part, overcomes the disadvantages and waste of the present poor grade of gasoline. It has a patent pneumatic carburetor, exclusively Hudson, self-adjusting to every engine speed.

In whatever you prize most—performance, style, beauty or economy—you will find the Hudson leader. That's why it leads all other front-rank cars in sales.

Phaeton, 7-passenger	*$1650*
Cabriolet, 3-passenger	*1950*
Touring Sedan	*2175*
Limousine	*2925*
Limousine Landaulet	*3025*
Town Car	*2925*
Town Car Landaulet	*3025*

(All prices f. o. b. Detroit)

HUDSON SUPER SIX

HUDSON MOTOR CAR COMPANY, DETROIT, MICHIGAN

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

SHOE LAST.—L. D. YORK, Portsmouth, Ohio. The more particular purpose in this case is to give the particular parts of the last such form that they may be readily be made of metal without unduly increasing the weight of the last as a whole. An object is to give the last such form as to render the use of wood unnecessary.

BRACELET LOCK.—E. R. NEBELING, 21 Maiden Lane, New York, N. Y. The invention has reference to a lock for bracelets. The object thereof is the provision of a lock which cannot be accidently operated and thereby unlocked, action being supplied which increases the resistance to an accidental displacement of the slide when it is pushed home.

DIE AND PRESS FOR ATTACHING WOOD HEELS.—M. ISAACSON, 1521 Pitkin Ave., Brooklyn, N. Y. This improvement relates to shoe-making machines and particularly to a die and press for preparing the heel seat portion of shoes to receive heels in such manner as to produce an accurate fit at the juncture of the heel with the remaining part of the shoe.

WATERPROOF-PAPER CAPE.—J. A. GAVIN, 16 Matthews Place, Flatbush, Brooklyn, N. Y. The invention relates to garments and has particular reference to emergency waterproof outer garments. It improves the facilities for manufacturing the cape whereby it may be formed mainly of a cheap material such as waterproof paper and yet possess the requisite strength for the purposes intended.

PIN CLUTCH.—M. SAPO, 40 W. 28th St., New York, N. Y. In this case the invention relates to a pin clutch, and the object thereof is to provide a simple, effective and inconspicuous clutch which can be fitted from either end and which will positively grip the pin so that the pin cannot be released accidentally.

Electrical Devices

ELECTRIC ADVERTISING DEVICE.—W. C. GILLESPIE, 208 Goodrich Bldg., Phoenix, Ariz. An object of this invention is to provide a device in which a series of slides or plates may be brought successively before a projecting apparatus where they may be left for a predetermined period and then moved while another slide or plate is brought into position.

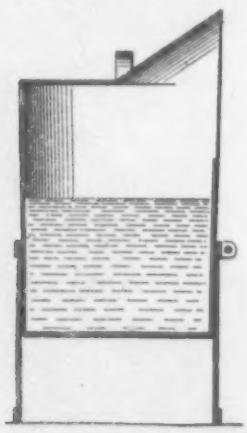
COMBINED RECEIVER AND DETECTOR FOR WIRELESS USE.—F. WALLBERG, 255 W. 95th St., New York, N. Y. The general objects here are to provide a telephone receiver and detector combined into a unitary device which is of such small size as to be conveniently carried about on one's person and which is easily and quickly connected to ground, and an aerial conductor for use in receiving wireless messages, the combined receiver and detector being held by the hand to the ear.

Of Interest to Farmers

HOG OILER.—C. A. FOX, care of MOORMAN MFG. CO., Quincy, Ill. By means of this device oil, disinfectant, insecticide, or the like; may be applied to the hog automatically during the operation of scratching, and wherein valve mechanism is provided for controlling the flow of the oil or the like, having operative mechanism directly engaged by the body of the hog to open the valves.

CRUSHING ROLL.—LAURENT G. G. DIBBETS, Hague, Netherlands. The invention provides rolls for sugar-cane mills having concave-convex teeth extending across the cylindrical surface. It further provides crushing rolls the teeth of which may be sharpened without removing the rolls from the crushing mill. A still further object is to provide crushing rolls having teeth so designed that the maximum strength of the teeth is in the central part of the roll.

MILK PAIL.—W. G. PARMELE, 4025 N. Kastner Ave., Chicago, Ill. The main object of the inventor is to provide a milk pail which minimizes the possibility of dirt entering the milk, as from the switching of the cow's tail,



MILK PAIL

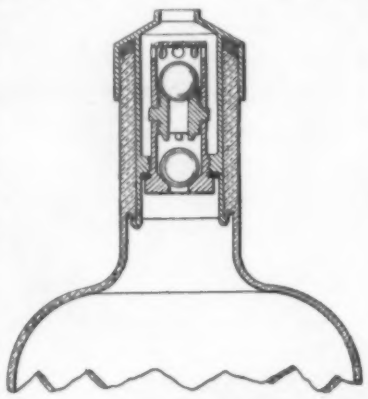
which prevents the milk from reaching the milker, which is convenient for carriage, which serves as a seat for the milker, which is very simple in construction, highly efficient in use, and thoroughly practical, and which is comparatively inexpensive.

Of General Interest

FRUIT STAND.—M. MARKS, 2144 Lake St., San Francisco, Cal. The prime object of the invention is to provide a sanitary fruit stand in which various fruits may be arranged in a manner affording ready access thereto. Another object is the production of a fruit stand of strong and durable construction and inexpensive to manufacture.

BOOK HOLDER.—M. LE VINO, 2788 Broadway, New York, N. Y. This inventor provides a bookholder more especially designed for use on desks for holding the telephone directory, reference book or other book within convenient reach of the user of the desk, and to allow the user to move the book into position for use without detaching it from the bookholder.

NON-REFILLABLE BOTTLE.—F. A. MERTZ, 1461 Rowland St., Bronx, N. Y. A specific object of this invention is the provision of a stopper, the parts of which are assembled before being

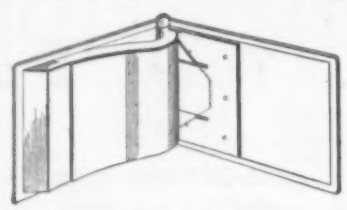


NON-REFILLABLE BOTTLE

inserted in the bottle neck, and then by simply pushing the device into the bottle neck, the same automatically locks, the various parts of the device being so constructed as to be comparatively simple to make and easy to assemble.

BARREL HEAD.—H. ELLIS, 14613 Westropp Ave., Cleveland, Ohio. The invention provides a barrel head which is especially adapted for steel barrels or other receptacles containing liquids, such as paint or varnish, and having means for locking the head to the barrel and for unlocking it when it is desired to have access to the contents of the barrel.

REMOVABLE BOOK-COVER. — W. R. HOTCHKISS, 316 Peoples Bank Bldg., St. Paul, Minn. This invention is an improvement in binders, and its object is to provide a device of this character for permitting fillers to be inserted or

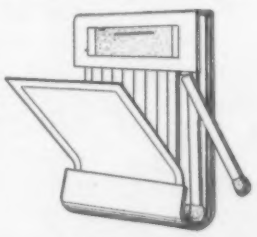


REMOVABLE BOOK-COVER

removed in a minimum of time with a minimum of effort, and wherein the filler will be held firmly in place against the possibility of accidental displacement, when inserted.

SOLDERING IRON.—F. MOENCH, Rushville, Ill. An object of this invention is the provision of a soldering iron which is more efficient than the ordinary soldering iron due to the fact that the body portion of the soldering iron consists of a combination of metals, each of which has its peculiar features.

MATCH HOLDER.—J. F. O'MALLEY, Box 585, Meriden, Conn. Mr. O'Malley's invention has reference to holders for book matches and the main object thereof is the provision of such holders which tend to prevent the ignition of the



MATCH HOLDER

remaining matches after one has been removed for ignition, wherein the matches are securely held, and which is preferably formed of one piece of material, as for instance struck up from sheet metal.

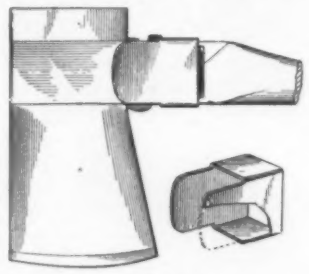
FOCUSING ATTACHMENT FOR CAMERAS.—W. EHRLICH, 3287 Decatur Ave., Bronx, N. Y. The device is so designed as to be capable of being fastened to a camera back by means of screws so as to do away with the focusing cloth, the device being in the form of a leather pocket having a reflecting mirror therein and a view opening at the top so that the focused image can be seen on the mirror with the image upright but reversed as to right and left.

TYPE CASTING APPARATUS.—C. VASICA, 371 14th Ave., Long Island City, N. Y. This invention provides an easily manipulated apparatus, whereby any block of material of special design, may be put into position for the formation of a matrix which may be preserved for the making of any desired number of duplicate devices precisely like the original.

FABRIC BOLT BOARD.—C. K. BAUMANN, Hotel Biltmore, New York, N. Y. This invention provides for renewal of index cards; increases the durability of articles of the character mentioned; provides storage capacity in the article mentioned; provides for reuse of the device; and provides for branding the article with the name or style of the proprietor.

Hardware and Tools

AX OR SIMILAR TOOL.—W. YANERT, P. O. Rampart, Alaska. This invention relates to tools having handles adapted to be secured thereto. One of the principal objects of the invention



AX OR SIMILAR TOOL

is to provide a means for connecting a handle to an ax in such a manner that the ax cannot possibly fly from the handle and yet the handle may be removed or interchanged with facility when desired. The large engraving shows a side elevation of an ax and the connecting means for the handle therefor and the small one shows a keeper or sleeve.

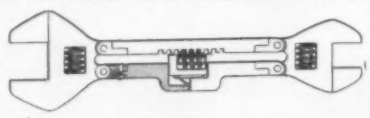
WELL DRILLING BIT.—G. L. LANE, care of Gallagher Oil Co., Marietta, Ohio. Among the principal objects here is to so construct a drilling bit as to insure the greatest efficiency and durability of the tool and to reduce to a minimum the liability of the drill hole becoming crooked and that the bit will go through the casing and drill the hole large enough to allow the casing to follow.

NUT LOCK.—H. BARNETT, Malvern, Ark. In this case the invention is an improvement in nut locks, and has for its object the provision of a simple, inexpensive yet efficient lock of the

NUT LOCK

character specified, and to provide a new and improved form of tool for placing the lock. The engraving shows the improved lock and the placing tool with the lock in closed position.

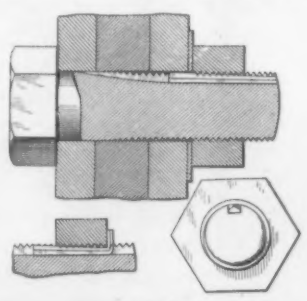
WRENCH.—W. H. REAGAN, JR., Box 1263, Miami, Ariz. This invention provides a wrench having heads at the opposite ends arranged to be simultaneously swung in their own planes through angles to convert the wrench into an S-wrench; provides for varying the angles through which the wrench heads are moved in their own planes;



WRENCH

provides for effecting the stated movements of the wrench heads by a relative movement of handle or shank sections; and provides wrench heads adapted to be swung at right angles to their own planes in addition to the angular adjustment in their own planes.

NUT LOCK.—J. ROHRHEIMER, P. O. Box 75, Shamokin, Pa. This invention relates to nut or bolt locks and may be also used for locking hub-nuts on the axles of vehicles. The bolt has a longitudinal slot or groove cut across the threads in which is laid a specially disposed key. In



NUT LOCK

turning on the nut, a partial thread is cut on the key, which appears as a series of transvere notches, the resultant friction holding the nut tightly in position which can be still further secured by turning up the end of the key. It provides a nut lock of the simplest form and can be manufactured at a low cost, the grooves being easily cut and the keys of relatively cheap construction.

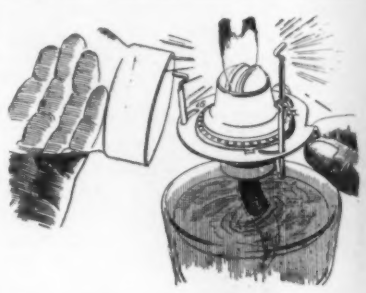
Heating and Lighting

TESTING APPARATUS FOR FLASHLIGHTS.—G. A. LEY, 1920 Warner Ave., Ravenswood, Chicago, Ill. This invention provides an electric circuit on which there is interposed, among other elements, a lamp and a pneumatically operated contact member for closing said circuit when it is desired to both test the ignition fuse and ignite the flash powder. It provides a lamp of greater resistance than the

TESTING APPARATUS FOR FLASHLIGHTS

igniting fuse so that only as much current will pass through the fuse as the lamp will consume, which will result in the lighting of the lamp, when the fuse is properly adjusted, without making the latter hot enough to ignite the flash powder, thus making it possible and safe to test the apparatus after the powder has been placed on the fuse

CHIMNEY HOLDING ATTACHMENT FOR LAMPS.—W. H. SLOAN, 919 Shallowford St., Winston-Salem, N. C. This invention relates more particularly to oil lamps and provides means whereby lamp chimneys may be readily, quickly, and positively clamped in position in

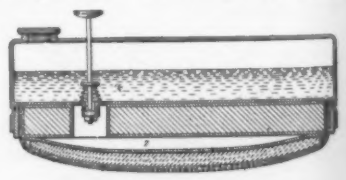


CHIMNEY HOLDING ATTACHMENT FOR LAMPS

connection with the lamp burner, and of such nature as that they may be quickly and easily released to permit of removal of the chimney for purposes of cleaning, repair, and substitution, when the lamp is lighted.

Household Utilities

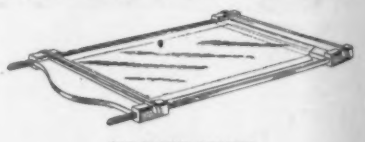
CLEANING DEVICE.—J. H. PEARMAN, Box 522 Lisbon, N. H. This invention provides a cleaning device of the fountain type which is



CLEANING DEVICE

so designed as to be adapted as a household article, whereby spots can be taken out of garments or other fabric without requiring them to be sent out to a professional cleaner.

FLY PAPER HOLDER.—C. W. RANDALL, 201 Lake St., West Hoboken, N. J. This invention provides a construction which effectively holds a strip of fly paper stretched flat with the frame protecting the paper, so that it cannot come in contact with other articles or be torn, and



FLY PAPER HOLDER

the frame forms a convenient means for enabling the paper to be leaned against or hung on a wall in vertical position, or enables it to lie flat on a table or other support. The device is also suitable for holding any article in stretched relation, as for instance, lace curtains.

STATIONARY ELECTRIC IRON HEATER.—A. S. ISERSON, 395 Fourth Ave., New York, N. Y. The inventor provides an electric connection for a flat iron which will be independent of the iron when the iron is in actual use for

(*Concluded on page 454*)

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VALUABLE INVENTION for gasoline and electric vehicles, aeroplanes, etc. Funnel indicating when receptacle is full; stops overflow instantly, retains remaining liquids in funnel; invaluable for gasoline, oils, wine, acids, etc. Simple construction; will demonstrate by appointment at 5456 Kimbark Avenue, Chicago; phone Midway 9463. George Heimgartner, inventor.

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PROPOSALS FOR AIR CONDITIONING EQUIPMENT.—United States Department of Agriculture, Washington, D. C., April 21, 1917. Sealed proposals for furnishing and installing air conditioning equipment at the Arlington Farm, near Rosslyn, Virginia, will be received here until 2 P. M., May 11, 1917, and then publicly opened. Specifications and detailed drawings furnished on application. Envelopes containing proposals should be endorsed "Proposals for Air Conditioning Equipment," and addressed to Chairman, Board of Awards, United States Dept. of Agriculture, Washington, D. C.

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A System of Mobile Coast Defense

(Concluded from page 435)

The emplacement consists of a monolithic platform, through the center of which runs a railway track, which is depressed sufficiently to bring the turntable of the gun approximately level with the top of the platform. Along each inner edge of this run-way is embedded and firmly anchored back into the concrete a heavy cast-steel longitudinal guide block, which is recessed on its inner face, so as to receive the base ring of the gun table. When the gun is in place, the base ring is shimmed up with steel plates until a firm bearing is secured, and it is held down in place by heavy screw bolts. By this arrangement the severe stresses of recoil do not reach the car, but are taken up directly by the concrete platform.

It can readily be understood that the provision of a series of these platforms, masked either by placing them in deep cuttings, or behind natural elevations, hills, sand banks, etc., and the provision, further, of numerous, well-appointed artillery trains, complete with rifles, mortars, and howitzers, and their accompanying ammunition and supply cars, would constitute a very flexible and powerful defense for the coastline of the United States.

Rapid Fire Soap Making

AT a meeting of the New York Section of the Society of Chemical Industry lately held at the Chemist's Club in New York City, the Perkin Medal was awarded to Dr. Ernst Twitchell of Cincinnati for his discovery of a new and improved method of separating fats with their fatty acids and glycerine. This has great value in the soap, candle and glycerine industries. By its use great economies are provided in the making of candles, the glycerine refiner is saved all sorts of trouble and expense by getting his glycerine free from salt and the soap-makers are able to use soda ash instead of the more expensive caustic soda.

Fats are combinations of fatty acids and glycerine. Soap is a combination of fatty acids with an alkali such as soda or potash. The old way to make soap is to boil the fat with some caustic lye. When the reaction is completed salt is added and then the soap floats to the top and is skimmed off and the glycerine mixed with salt and with the completion of this operation only water remains behind.

Dr. Twitchell provided a "saponifier" of which no more than one-half of one per cent, added to the fat under proper conditions, will split the latter completely into its component parts of fatty acids and glycerine. Chemically spoken, his saponifier is a fatty aromatic sulphonic acid which acts as a catalyst. That is, while nothing in particular seems to happen to the saponifier, and it is just a plain, common-looking chemical that does not explode or show off under ordinary circumstances, as soon as only a little bit of it comes into the intimate presence of fat under the proper conditions, it good-bye fat! The fat cannot stand it; it disintegrates straightway into various fatty acids and glycerine.

The invention can hardly be called a lucky strike, because it is the result of years of patient labor and research, beginning with a profound study of the theory of the subject and keeping at it for years and years until he had the trick turned. When he graduated from the University of Cincinnati in 1886, he was employed as chemist by a large candle manufacturing company. He was engaged to make analyses, but he had ideas and he did everlastingly study the chemistry of fats and oils. His laboratory was only a little lean-to against a still, 'way out in an otherwise open field. He soon earned a better place to work with more conveniences. Within less than ten years Dr. Lewkowitsch of England, the leading authority on oils and fats of his day, referred to Dr. Twitchell as a benefactor to industry. He is now chemical director of the same candle company and is president as well as director of several enterprising corporations that have full control of all his inventions.

$1150 F.o.b. Racine
Price will be advanced to $1195 on May 10th
Mitchell Junior—a 40 h.p. Six
120-inch Wheelbase

$1460 F.o.b. Racine
7-Passenger—48 Horsepower
127-inch Wheelbase

Mitchell SIXES

For 200,000 Miles

John W. Bate, the builder of Mitchells, stands for life-time cars. So we aim to have Mitchells give 200,000 mile service. Two Mitchells already have proved that they can do that.

To this end we have doubled our margins of safety in the past three years. Our standard now in every part is 100 per cent over-strength. Never before have cars built like Mitchells been built at Mitchell prices.

Let your Mitchell dealer show you what this means. Ask him for a list of great engineers who selected the Mitchell because of its endurance. You will certainly choose the car they chose, if you buy in the Mitchell class.

$4,000,000 in Extras

Mitchells have a wealth of features which other cars omit. On this year's output these extras cost us about $4,000,000.

There are 31 valuable features which most other cars omit. Things like a power tire pump, for instance.

There are cantilever springs which have never broken. There are oversize steering parts, built of Chrome-Vanadium. There is 24 per cent added luxury over our last year models.

All of these extras are paid for by savings, due to our wonderful factory efficiency. John W. Bate's methods, in the past few years, have cut our factory cost in two. The added luxury is paid for by savings made in our new body plant.

An Amazing $1150 Six

You will see this year a new Mitchell Six—Mitchell Junior. It has 40 horsepower and a 120-inch wheelbase. But it sells for $1150 at factory. No other car around that price comes anywhere near its value.

Yet the larger Mitchell is sold on the same basis. And it comes in all styles of bodies.

You will find no other car which gives you, in these ways, what you get in the Bate-built Mitchell.

TWO SIZES

Mitchell—a roomy, 7-passenger Six, with 127-inch wheelbase and a highly-developed 48-horsepower motor.
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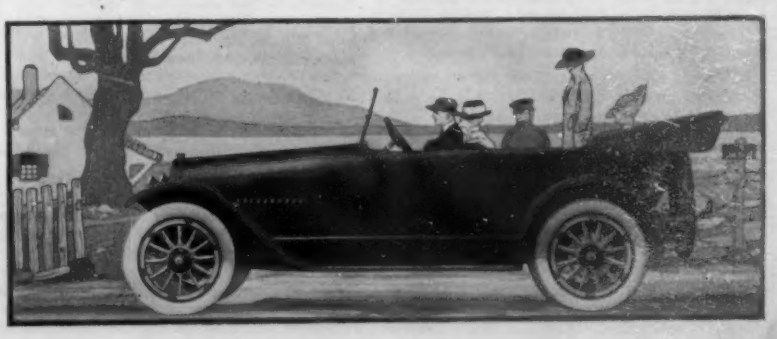


RECENTLY PATENTED INVENTIONS

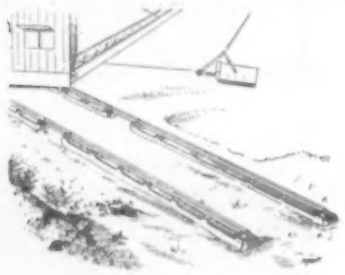
Concluded from page 452)

laundrying purposes, thereby making the iron free and independent from all mechanical obstructions which tends to interfere with the free use thereof.

Machines and Mechanical Devices

REDUCING VALVE.—C. N. SOWDEN, Santa Cecilia, Guatanamo, Cuba. Mr. Sowden's improvement relates to reducing valves to be used in connection with apparatus in the sugar industry and particularly to multi-effect evaporators to regulate the vacuum between each body or where the reducing pressure for evaporating purposes should be in proportion to the initial pressure used for power purposes.

TRACK FOR LAND DREDGES.—F. GODDARD, Parma, Mo. The invention is an improvement in tracks for land dredges, and has for its object the provision of a track consisting of sections, wherein the sections are so arranged



TRACK FOR LAND DREDGES

that they may be moved by the dredge from the rear of the dredge to the front, to provide in this manner a continuous trackway. The engraving shows the track in use.

COMBINED STOP VALVE, AUTOMATIC LIMITED PRESSURE VALVE, AND FULL PRESSURE SUPPLY VALVE.—T. B. FORD, 407 Broome St., New York, N. Y. In carrying out the invention use is made of a valve body provided with an inlet, an outlet and a valve seat intermediate the said inlet and outlet, a valve adapted to be seated on the said valve seat and manually controlled means for setting the said valve into stop position, automatic limited pressure or full pressure supply position.

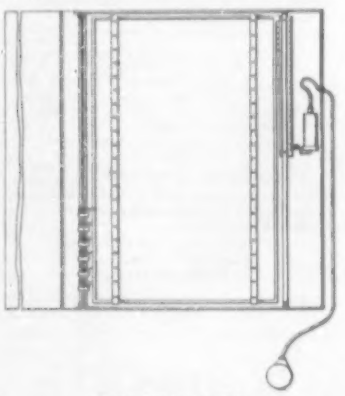
SAFETY SIGNAL FOR FIREARMS.—W. YANEST, P. O. Rampart, Alaska. This improvement has particular reference to means to usually indicate at the outside of the firearm whether or not the same is loaded. Therefore, it provides a

SAFETY SIGNAL FOR FIREARMS

firearm with a signal movable so as to occupy different positions according to whether the firearm is supplied with a shell or cartridge or not, so that when the weapon is held in the operator's hands, he will be able to know positively whether it is empty and if the signal shows that it is loaded, he will be put on his lockout.

Musical Devices

MUSIC LEAF HOLDER.—J. A. SCROGGIN, 210 Main St., Little Rock, Ark. This improvement provides a music leaf holder, of book-like form, which may be used in holding sheets of



MUSIC LEAF HOLDER

music of various sizes, the device being of such nature that it may be mechanically operated for turning the sheets of music one at a time, without the necessity of the operator or musician removing his hand from the instrument he is playing.

Prime Movers and Their Accessories

ELECTRIC HEATER.—R. R. GRIMSHAW and LA MAR R. JONES, care of the latter, 1111 E. 113th St., Cleveland, Ohio. This invention relates more especially to heaters designed for heating the incoming air prior to its passage through the carbureter of an internal combustion engine. It provides a device which may be readily installed on the engines of automobiles and the like, without the necessity of dismantling the engine or rearranging the parts.

INTERNAL COMBUSTION ENGINE.—H. C. WELL, 1175 Wyatt St., Bronx, N. Y. The engine has a piston with a rotatable valve member with a port which is adapted to receive the combustible mixture through the port in the side of the cylinder, the rotatable valve member also having ports which are adapted to register with ports in the piston to permit of a quick circulation of air in the cylinder to cool the cylinder and clear it of all products of combustion.

Railways and Their Accessories

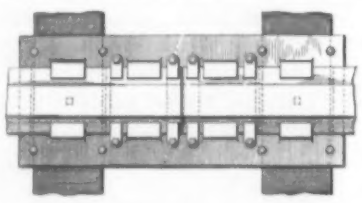
AIR COUPLINGS.—J. G. COFFIELD, 816 Windsor Ave., Norfolk, Va. This invention pertains generally to automatic coupling arrangements for air and steam hose between railway cars, and more particularly to an arrangement whereby automatic coupling may be provided for, the object being to provide a practical construction for this purpose, as well as one capable of ready adaptation to the under-rigging of cars at points immediately below the draw heads thereof.

SLIDING HORN KICK BACK DUMP.—T. M. BOGGS, Monongahela, Pa. One of the principal objects of the invention is the provision of an improved dump of such a nature that the mine car when upon the dump, and after it has been emptied of its contents, is kicked or precipitated off of the dump automatically in order to be returned to the point of loading.

EXPANSION BOLT.—T. HAND, P. O. Box, 663 New Haven, Conn. The invention provides a bolt consisting of a main section, and end sections connected thereto in a novel manner whereby said end sections are adjusted laterally relative to the main section when the bolt is being fastened so that said end sections will bind against the wall of the bolt opening and thus securely retain said bolt in locking position.

BRASS REMOVER FOR JOURNAL BOXES.—P. E. VALENTINE, Caneyville, Ky. This device is especially adapted for removing brass from Journal boxes of railway cars, and wherein means is provided for grasping the brass in the journal box and for withdrawing the brass from the journal box, and wherein other means are provided for lifting the grasping means to cause the brass to clear the flange on the axle.

RAIL TIE PLATE AND RAIL FASTENER.—F. CALDWELL, 7510 Cornelia Ave., Carthage, Cincinnati, Ohio. This invention relates generally to rail tie plates having means to receive and to hold rails without the use of spikes entering the



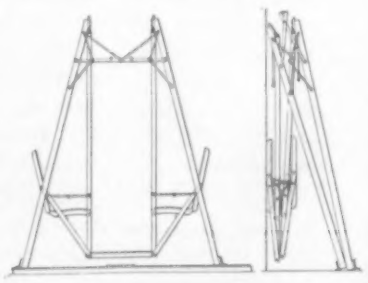
RAIL TIE PLATE ANE RAIL FASTENER

ties, as is usual, the object being to provide tie plates connecting two adjacent ties in such manner as to prevent both spreading movement of the ties and the rails supported by the plates

Pertaining to Recreation

MOVING PICTURE FILM WIPER.—E. DUCHER, 257 Jackson Ave., Jersey City, N. J. This improvement provides a wiper adapted to maintain a yielding pressure on the film during the operation of wiping; provides a wiper which may be readily and easily installed in service; and provides means for replacing and retaining wiping surfaces for the film.

LAWN SWING.—J. M. MAYER, 11 Cottage Road, Kingston, N. Y. Among the principal objects which the present invention has in view are: to provide a structure of the character mentioned which may be closely folded; to provide



LAWN SWING

a light frame; and to reduce the cost of construction of an apparatus of this character. The first engraving represents a side view of the swing, the same being shown disposed as in service; and the next one presents a side view of the same, being shown as folded and out of service.

AMUSEMENT AND EXERCISING APPARATUS.—MADELEINE G. RIVES, The Victoria, 315 W. 97th St., New York, N. Y. This improvement provides an amusement and exercising apparatus more especially designed for use by young people and arranged to provide a healthful exercise as well as amusement for the users and to take up very little room and thus render the apparatus especially serviceable in the nursery.

EYE FOR DOLLS.—D. PUDLIN, care of Pioneer Novelty Mfg. Co., 329 E. 29th St., New York, N. Y. This inveniton relates to eyes for dolls and provides eyes, and means for connecting the eyes together, of novel, and inexpensive construction. It provides a metallic connecting piece between the eyes which is capable of being bent to properly adjust the eyes with respect to the inequalities of the eye sockets of the doll's head, and means provide for easy and quick adjustment of the eyes to obtain the proper set.

MINNOW HOLDER.—H. D. CAMMACK, Crossett, Ark. This invention provides a holder that may be readily attached to a fishing pole or rod to house the minnow or bait hooks for conveniently carrying the same without danger of the hooks catching in the person or clothing of

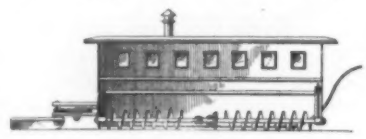
MINNOW HOLDER

the fisherman or foreign bodies; and provides a minnow holder which, when attached to the pole, will permit of a minnow on the end of a fishing line being conveniently placed in or removed from the holder, the cover of the latter having provision for the lateral entrance and removal of the fish line.

MOTION PICTURE APPARATUS.—J. F. DAVIDSON, Rural Route No. 3, Marlow, Okla. This improvement provides means for intermittently advancing the sensitized picture strip through the optical field of the apparatus and maintaining the same stationary for a definite interval prior to each advancement, the mechanism in question being equally adapted for motion picture cameras or projecting apparatus.

Pertaining to Vehicles

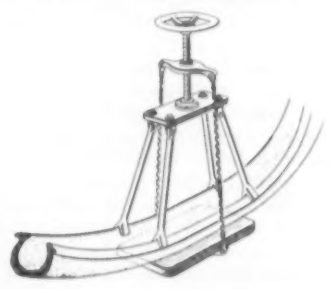
VEHICLE.—C. ROGGASCH, Deceased. Address Mrs. A. Roggasch, Box 114, Ainsworth, Neb. This invention has particular reference to a power propelled vehicle adapted for travel over ice, snow and bodies of water. It provides



VEHICLE

a vehicle of the sled type which may be propelled by an engine and which includes a plurality of traction or propelling elements arranged in a novel manner and operated by said engine to propel the vehicle.

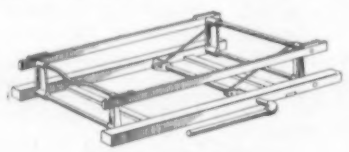
TIRE OR CASING SPREADING TOOL.—J. B. STROUD, Pass Christian, Miss. This invention relates to a tool for spreading tires or tire shoes or casings adapted for use in connec-



TIRE OR CASING SPREADING TOOL

tion with automobile and other rubber tires. Another object is to provide a device by which an automobile or other rubber tire or shoe may be opened at any point and retained in such open condition while repairs are being made

AUTOMOBILE JACK.—E. HAAKENSON, Box 45 a R. F. D., No. 3, Tacoma, Wash. This jack is particularly adapted for use with vehicles, by means of which an automobile may be raised entirely from the ground or from the floor of a garage in one operation. The invention provides



AUTOMOBILE JACK

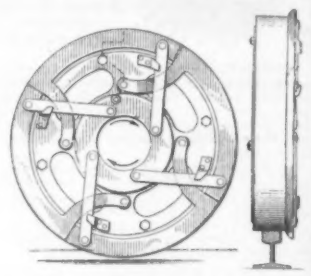
such a jack which folds into compact form when not in use, which is of the utmost simplicity in construction and use, which is capable of great lifting power with relatively little effort, which is self-locking when supporting its load, and which is comparatively inexpensive.

SLED.—O. O. BROTHEN, Westby, Wis. This invention relates to sleds, particularly for use on narrow roads and in rough country and provides means for preventing tipping when making turns even with top heavy loads, which means will maintain the load evenly balanced when turns are made. The inside runner advances and the outside runner recedes in making a turn, in the manner of an automobile.

MOTOR RADIATOR AIR DRAFT CONTROL.—W. E. STEPHENSON, Roosevelt, L. I., N. Y. This inventor provides a device whereby air may be caused to circulate through some part of the radiator of a motor vehicle while it is excluded from other parts. He provides a device whereby air may be caused to circulate through the entire radiator or prevented entirely from circulating through the radiator.

VEHICLE BAR SPRING UNIT.—M. S. SENDERLING, 333 Fairmount Ave., Jersey City, N. J. Among the principal objects which the present invention has in view are: the provision of means for installing the improved springs and mountings therefor on a relatively light structure, and the provision of a spring unit removably attachable to a vehicle.

COLLAPSIBLE WHEEL FLANGE.—R. L. MUNSON, 34 E. Elizabeth St., Detroit, Mich. This improvement provides a device for attachment to the wheels of motor or other vehicles, wherein the flange is sectional, and is supported



COLLAPSIBLE WHEEL FLANGE

on the wheel in such manner that it may be collapsed within the periphery of the wheel, when the wheel is on the road, and which may be expanded beyond the periphery to permit the wheel to be used upon rails.

TIRE PATCH CLAMP.—H. BRETTHAUER, 617 Courtland Ave., Bronx, N. Y. The invention relates to a tire patch clamp for the purpose of holding the patch and tire compressed together during the setting of the cement. It has for its

TIRE PATCH CLAMP

general objects a tool which is of simple construction, efficient and reliable in use, and so designed that the patch of a tire can be easily, quickly and effectively performed. The lower engraving shows a sectional view of the tool, tire and patch.

FOLDING SEAT FOR PERAMBULATORS.—W. J. STOLZ, 500 Cranier St., Milwaukee, Wis. The invention provides an attachable seat for temporary use; provides a seat which may be

FOLDING SEAT FOR PERAMBULATORS

folded within small compass; provides means for altering the active disposition of the seat; and provides a seat which may be quickly disposed in active and inactive positions.

FRONT AXLE BRACE.—R. BRITTAIN, Downsville, N. Y. This inventor provides a supplemental brace rod having a yoke at its front end which clamps to the center of the front axle, and a crotched rear end which engages the vortex or angle at the rear ends of the radius rods, the brace rods serving as an attachment which is easily and quickly applied to cars already in use.

BRAKE FOR VEHICLES.—G. STICKNEY, Carlton, Ore. The invention provides a brake which has teeth and which operates by the movement of the teeth into engagement with the ground. The parts of the brake may be readily assembled,

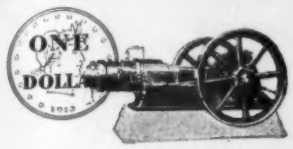
BRAKE FOR VEHICLES

it being possible to adjust the brake to dispose various kinds of teeth as desired, and thereby meet various requirements. The engraving shows the manner in which the brake is mounted on a vehicle.

Designs

DESIGN FOR AN ARTICLE OF MANUFACTURE.—S. GEISMAN, 27 Spruce St., New York, N. Y. In this design the article of manufacture comprises, for instance, a sheet of leather ornamented with very irregular and highly original ornamental pattern features.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.



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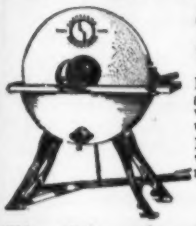

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The Submarine Swatter

(Concluded from page 439)

thing from Diesels to reciprocating steam engines might be used; but we believe that the Department has come to favor a triple installation of 250-horse-power air-starting and reversing motors of the type used in pairs in the British 80-footers.

Of vital importance in a vessel to fight the modern U-boat is the armament. With the means now at hand, it is necessary to get in your hits while the submarine is on the surface and at such a time she is a formidable foe and not easy to hit, unless the pursuer happens to be in the neighborhood when she is coming up and can do his work before she is able to bring her deck gun into play.

The standard navy three-inch gun is long and heavy, requires a crew of seven men and has a tremendous recoil pressure, but we understand that there is a modified gun being brought out which is much lighter, handles from the shoulder like a three-pounder and requires a much smaller crew. To be sure, in such a gun, some of the muzzle velocity would have to be sacrificed; but, after all, it would not be practical to shoot at a range of more than a mile on such a small quick-acting vessel, and it would seem that the ability to use a projectile weighing nearly fifteen pounds would be worth the sacrifice. The new U-boats are quite heavily armored in their exposed parts and we believe that a one-pounder, a three-pounder, or even a six-pounder, which is the size decided on by the Department for the new patrol boats, will be found inadequate, especially in view of the fact that the submarines themselves are being equipped with three- and four-inch guns.

Before long we shall probably develop some device for getting at submarines while submerged, either as we have said, by means of a torpedo released from an aeroplane or by means of a marine torpedo of the usual type. A year ago the writer suggested a 100-foot patrol boat equipped with a deck torpedo-tube amidships and from the Navy Department's recent experiments with one of Mr. Hickman's "sea sleds" and a fast 50-foot V-bottom, recently delivered, both of which were designed to carry torpedo tubes, it looks as if the Government actually is interested in such an idea.

Future Fertilizer Supplies and Requirements

(Concluded from page 449)

usual need of some crop which demands large quantities of this element.

The sources of nitrogen for fertilization are ever increasing in number. To be sure, the supply of nitrate of soda is getting smaller and the demand for it for destructive purposes has increased enormously since the beginning of the war. But the manufacture of sulfate of ammonia in connection with the production of coke should add greatly to the fertilizer supplies of the country. And while the direct utilization of cottonseed meal as a fertilizer should decrease because it is a waste of a valuable feeding material, most of the fertilizer value of the meal should be recovered in the manure from the animals fed. The same is true of soy bean and peanut meal, which promise to become products of importance. Then, too, the supply of fish scrap available for fertilizer may reasonably be expected to increase if the predicted increase in the use of fish for food ever materializes. Finally, the different processes of securing nitrogen from the atmosphere make available unlimited quantities. Their value depends upon the ability to secure the nitrogen by this means at a cost no greater than that of the familiar nitrogenous materials used as fertilizers. It is expected that the government plant, if erected, will reduce the cost of nitrogen in fertilizing materials somewhat, but this, as yet, is only expectation.

On the whole, there is no reason for worry over our future supply of fertilizing materials. The highest problem connected with the whole business is the planning and adoption of the best farming systems.

OIL BANKING

How shrewd motorists save money

WHEN most car owners were novices, strong words made strong impressions.

But today the roads are toured by millions of veterans. These veterans have learned how to test words. They know how to prove or disprove claims.

If you are a veteran you know this: An oil that burns up rapidly or breaks down quickly cannot be really cheap. Though it may be low-priced by the gallon, it is bound to prove high-priced by the mile.

You know that a wrong-bodied oil raises your gas consumption. Instead of saving your oil pennies it eats up your gas dollars.

You know that wear-and-tear on the metal parts means, some day, a heavy bill which the low price per-gallon can never wipe out.

In recent years no oils have made such steady progress toward a dominant place in the market as Gargoyle Mobiloils.

Why?

Because now-a-days the great bulk of lubricating oil is sold to automobile veterans—men who have learned that gasoline saving depends largely on thorough piston-ring seal—who know that the piston-ring seal depends solely on the *body and character* of their lubricating oil.

Because the veteran knows that an oil which uses up rapidly is not lubricating properly.

Because the veteran automobilists of today know that the higher price per gallon of Gargoyle Mobiloils means a lower cost per mile in operating expense.

Write for new 56-page booklet containing complete discussion of your lubrication problems, list of troubles with remedies and Complete Charts of Recommendations for Automobiles, Motorcycles, Tractors and Marine Engines.

Correct Automobile Lubrication

Explanation:—The four grades of Gargoyle Mobiloils, for engine lubrication, purified to remove free carbon, are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

In the Chart below, the letter opposite the car indicates the grade of Gargoyle Mobiloils that should be used. For example, "A" means Gargoyle Mobiloil "A." "Arc" means Gargoyle Mobiloil "Arctic," etc. The recommendations cover all models of both pleasure and commercial vehicles unless otherwise noted.

Model of CARS	1917 Summer	1917 Winter	1916 Summer	1916 Winter	1915 Summer	1915 Winter	1914 Summer	1914 Winter	1913 Summer	1913 Winter
Abbott-Detroit (8 cyl)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
Allen	A	Arc.	A	Arc.	A	Arc.	A	A	A	A
" (Mod. 33-34-35)					A	Arc.				
Apperson (8 cyl)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (8 cyl)	A	A	A	A						
Auburn (4 cyl)			A	Arc.	A	Arc.	A	A	A	A
" (6 cyl)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Autocar (2 cyl)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Avery			A	A	A	A	A	A	A	A
" (Mod. 5 & C ton)			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Briscoe (8 cyl)	A	Arc.	A	Arc.	A	Arc.	A	Arc.		
			A	A						
Buick	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Cadillac (8 cyl)	A	A	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Case	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Chalmers			Arc.	Arc.	Arc.	Arc.	A	A	Arc.	Arc.
" (Mod. 6-40)			A	Arc.						
" (Mod. 6-30)	A	A	A	A						
Chandler Six	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Chevrolet	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	A
Cole			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (8 cyl)	A	A	A	A	A	A				
Cunningham					Arc.	Arc.	Arc.	Arc.	A	A
" (8 cyl)	A	A	A	A						
Daniels (8 cyl)	A	A	A	A						
Dart	A	Arc.	A	Arc.	Arc.	Arc.	A	A	A	Arc.
" (Mod. C)	A	Arc.	A	Arc.	A	Arc.	A	A		
Delaunay-Belleville					A	A	B	A	B	A
Detroiter	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	A	A	Arc.
" (8 cyl)					Arc.	Arc.				
Dodge	A	Arc.	A	Arc.	E	E				
Dort	A	Arc.	A	Arc.	A	Arc.				
Empire (4 cyl)	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (6 cyl)	Arc.	Arc.	Arc.	Arc.						
Federal	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Fiat	B	A	B	A	B	A	B	A	B	A
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	A	A	A	A	A	A	A	A	Arc.
Grant	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.		
H. A. L.	A	A	A	A						
Haynes	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (12 cyl)	A	A	A	A						
Heine (8 cyl)			A	A						
Hudson			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
" (Super Six)	A	Arc.	A	A						
Hupmobile	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Jeffery	A	Arc.	A	Arc.	A	Arc.	A	A		
" (Chesterfield)	A	Arc.	A	Arc.	A	Arc.				
" Com'l.	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.
Jordan	Arc.	Arc.								
Kearns			E	E	E	E				
" Com'l.	A	Arc.	A	Arc.	A	Arc.				
Kelly Springfield	A	A	A	A	A	A	A	Arc.	Arc.	
King					A	Arc.	A	A	E	
" (8 cyl)	A	A	A	A	Arc.	Arc.				
" Com'l.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.				
Kissel Kar	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" Com'l.	A	Arc.	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
" (Mod. 48)			A	A	A	A	A	A		
Lexington	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.				
Liberty (Detroit)	Arc.	Arc.								
Lippard Stewart	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (Mod. M)	A	Arc.	A	Arc.						
Lozier	E	E	E	E	E	E	E	Arc.	Arc.	
Marion Handley	Arc.	Arc.								
" (Mod 6-40)	A	Arc.								
Marmon	A	A	A	A	Arc.	A	Arc.	A	Arc.	
Maxwell	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	
Mercer	A	A	A	A	Arc.	A	Arc.	A	Arc.	
" (22-70)					Arc.	Arc.				
Mitchell	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Mitchell (8 cyl)			A	A						
Moline									A	Arc.
" Knight	A	A	A	A	A	A	A	A		
Moon (4 cyl)					Arc.	Arc.	A	Arc.	Arc.	Arc.
" (6 cyl)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Murray (8 cyl)	A	A								
National	Arc.	Arc.	A	Arc.	A	Arc.	A	A	A	A
" (12 cyl)	A	A	A	A						
Oakland	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
" (8 cyl)			A	A						
Oldsmobile			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (8 cyl)	A	A	A	A						
Overland	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Owen Magnetic	A	Arc.	A	Arc.	A	Arc.				
Packard			A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
" (12 cyl)	A	A	A	A						
" Com'l.	A	A	A	A	A	A	Arc.	Arc.	Arc.	Arc.
Paige					A	Arc.	A	A	A	E
" (6-46)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.				
" (6-36 & 38)	A	Arc.	A	Arc.	A	Arc.				
Pathfinder	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	A	Arc
" (12 cyl)	A	A	A	A						
Peerless	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (8 cyl)	A	A	A	A						
Pierce Arrow	A	A	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" Com'l.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Premier	A	A	A	A	A	A	A	A	A	Arc.
Pullman	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Regal	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
(8 cyl)	A	A	A	A	Arc.	Arc.				
Renault			A	Arc.	A	Arc.	A	Arc.	A	Arc.
Reo	A	Arc.	A	Arc.	A	Arc.	A	A	A	Arc.
Richmond	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
Riker	E	E					B	A		
Saxon	E	E	E	E	E	E	B	A		
Scripps-Booth (air)										
" (water)	A	Arc.	A	Arc.	E	E				
" (8 cyl)	A	A	A	A						
Selden	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Simplex	A	A	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Stearns-Knight	A	A	B	A	B	A	B	A	A	A
" (8 cyl)	A	A	B	A						
Sterling (Wisconsin)	A	Arc.	A	Arc.						
Studebaker	A	Arc.	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Stutz	A	A	A	A	A	A	A	Arc.	Arc.	Arc.
Velie (4 cyl)					A	Arc.	A	Arc.	A	Arc.
" (6 cyl)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Westcott	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
White	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Willys-Knight	A	A	B	A	B	A	A	Arc.		
Willys Six	Arc.	Arc.								
Winton	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.

Electric Vehicles: For motor bearings and enclosed chains, use Gargoyle Mobiloil "A" the year 'round. For open chains and differential, use Gargoyle Mobiloil "C" the year 'round.

Exception: For *winter lubrication* of pleasure cars, use Gargoyle Mobiloil "Arctic", for worm drive and Gargoyle Mobiloil "A" for bevel gear drive.

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Mobiloils

A grade for each type of motor

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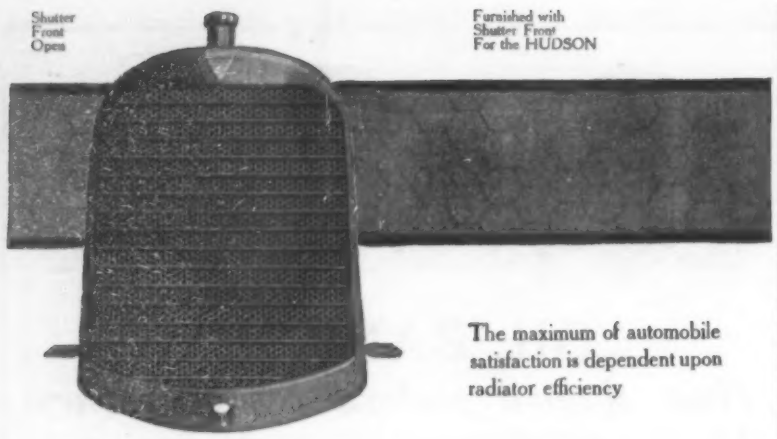

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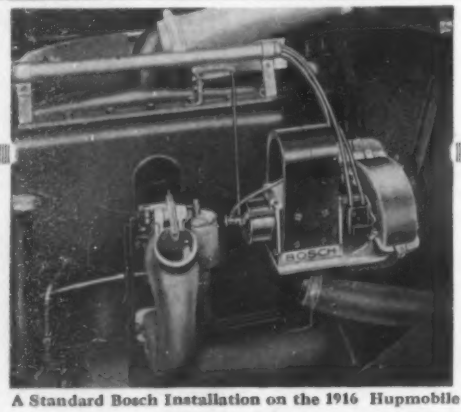

A Standard Bosch Installation on the 1916 Hupmobile

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Ignition is a puzzle to most car owners and you should have a "no worry" system. The reliability and efficiency of Bosch Magnetos are unquestioned.

We now supply magneto attachments for most battery equipped cars.

Send for "More Efficiency"

BOSCH MAGNETO COMPANY

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CHICAGO DETROIT SAN FRANCISCO

Service Stations in Every State

Generals of Shadowland Warfare

(*Continued from page 447*)

Prompted, no doubt, by the success of his earlier production, Director Griffith undertook America's first motion picture classic, "The Birth of a Nation." In the battle scenes of this production thousands of actors afoot and on horseback were employed, and in all it is claimed that something like 15,000 people took part in the picture. The direction of the big scenes was facilitated by the use of a telephone system, and Director Griffith, perched high above the field, was able to talk with his cameramen and sub-directors, ordering out the cavalry at the right moment, the artillery fire at another, and the various attacks where and when desired. One cannot help comparing this task to that of a painter working on a battle scene: the director, even if he does not wield the brush and pencil and pigments, none the less creates the beautifully-finished picture which is ultimately presented on the screen.

Fighting Blood and Film Realism

When viewing the average battle scene the question invariably arises in the mind of the spectator: Are they really fighting? It is the striking realism of the pictures that brings forth this query, and the answer is that the men do fight, often earnestly, although they inflict little damage upon one another since all kinds of precautions are taken to keep the battle in the sham state. The story is told of how 3,000 colored actors, partaking in some of the scenes in the "Birth of a Nation," were thoroughly alarmed by the vicious charges of the Ku-Klux Klan men, and as a result over half of them deserted and refused to finish the scenes in which they were slated to appear. Coaxing having utterly failed, a new lot of men had to be hired, causing a serious loss of time and money. This occurrence is not unusual; for the men often take a keen, almost too real, interest in their work, forgetting that they are fighting not for king and country but for a few hundred feet of animated celluloid ribbon—and two dollars or so per day.

Accuracy is an essential in the high grade production, and in taking his first classic motion picture Griffith paid particular attention to the small details. Rumor has it that during a big battle scene a dispute arose among the actors as to the color and kind of horse ridden by the famous commander-in-chief of the Confederate forces, Robert E. Lee, when he was campaigning at the head of the Army of Northern Virginia. Griffith was away at the moment.

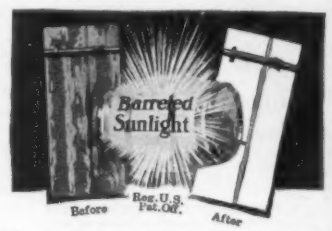
"Better stop 'taking,'" suggested one of the actors to the cameraman, "till we telephone in and have the facts about General Lee's horse looked up and verified."

A high-powered touring car had glided up behind the group. In it sat Griffith himself.

"What's the fuss about?" he inquired. When told, he smiled tolerantly. "Why, Lee's dappled gray charger 'Traveler,'" he remarked, "is one of the three most famous horses in history. Bucephalus' and Napoleon's nag were the other two, and I've got a horse as near like 'Traveler' as possible waiting in that stable yonder. Go on with your 'take.'"

In his second classic production, "Intolerance," Director Griffith secured his idea from a Federal Industrial Commission report, which stated that a large number of men had gone out on strike owing to insufficient pay in the face of the rising cost of living, and that when the strike was quelled by exceptionally "strong arm" methods, 19 strikers were missing—the victims of the corporation's guards. With little else to work from except this report and historical accounts, Griffith set about producing his master play which depicts four big epochs in the history of mankind; in fact, it is said that he did not employ a conventional scenario. Thousands of actors appeared in the various scenes, and the accuracy of the historic events has been highly praised by connoisseurs.

In the production "Civilization," directed by Thomas H. Ince in California,



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A Text Book for the Guidance of Finger Print Experts and an Instructor for Persons Interested in the Study of Finger Prints

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The finger print system of identification is now in use in many of the police departments in this country and abroad. The United States Government has adopted it and requires every private in the United States Army to have his finger prints taken on enlistment.

The finger print system will no doubt, sooner or later, be adopted by large corporations employing many hands, for identifying their employees; by insurance companies to positively identify the deceased and prevent fraud in the collection of insurance; by banks to prevent forgery and the withdrawal of funds by unauthorized persons; by institutions, firms, departments, etc., in which the identification of individuals is one of the requisites.

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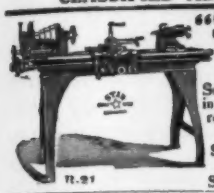

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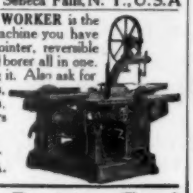

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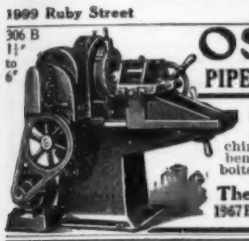

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Established in 1906 Making Lathes over 10 years

For the Machine and Repair Shop
LOW IN PRICE
12 in. to 24 in. swing
Straight or Gap Beds.
Send for free catalog giving prices on entire line.
How to Run a Lathe
A 64 page book
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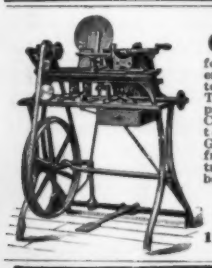

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They will work more faithfully for you under all conditions, stand harder wear and outlast other tools if you will specify
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A complete line of Pliers, Screwdrivers, Snips, Glass Cutters, Hack Saws, etc. You will consider their ownership the best investment.
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Practical advice of 40 years' experience (not professional) absolutely free. No string attached. Charge only if models desired.
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The most accurate made and prices reasonable. We carry a complete line of gears in stock for immediate shipment. Can also quote on special gears of all kinds. Send us your inquiries.
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Specialists in Small Wire Shapes & Flat Stampings
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The Oswego Machine Tool & Die Works wishes to announce that they are equipped with finest machinery and employ best tool and model makers in the country to take care of developing and building models for inventors. Will quote on the work at reasonable flat hour basis or contract. If interested, write us for particulars.
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Strong Diamond Tool Holders
and many other tools for factory, shop, garage and home—many high class tools attractively priced in our "Odds and Ends" pamphlet, which is mailed free on request.
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the wig-wag system of signaling was employed in the big mob scenes. Instructions were given over a large area by flag-signaling, in much the same manner that the Navy and Army units converse with one another at a distance. In order to obtain several spectacular rain scenes, a 300-foot hose was stretched from the ocean to a plateau on which was stationed the camera. At a given signal the pumps were set working and two nozzles played even streams on the assembled players, while the camera recording the action was shielded by means of a large umbrella.

Ensuring Communications with the Telephone, Wig-Wag and Wireless Telegraphy

Among the latest productions "Joan the Woman," a Lasky film story based on the life of the immortal Joan of Arc and produced in California under the direction of Cecil B. DeMille, contains a number of inspiring battle scenes. Fourteen hundred men took part in the battle scenes which extended over one hundred acres. DeMille was assisted by 12 directors stationed with cameras at various advantageous points around the field. Each director, as well as DeMille, was equipped with a standard telephone operator's set, an arrangement which enabled the director-general to control the movements of the participants and direct the entire action of the battle from his post at the center camera stand. Everything that DeMille spoke here could be heard in the 12 different parts of the field by the 12 sub-directors at their respective cameras. Although it is usual to spend at least two days in rehearsing a big battle scene, by means of the telephonic instructions as given by Director DeMille it was found possible to start taking pictures after less than one hour's preparation.

Over 2,700 men, among them 1,200 soldiers belonging to the California National Guard, 325 horses, several batteries of field guns and 25 aeroplanes, and one armored tractor or "tank" figured in the battle scenes of the International serial picture "Patria," directed by Jacques Jaccard. Various means were employed in transmitting the director's instructions, among them the telephone, wig-wagging, and wireless telegraphy. The latter was necessary in directing the airships which took part in the battle scenes, and which could not be reached in any other manner quite so effectively. All the latest phases of warfare were depicted in these battle scenes, and something like three months was required for the battle episodes of the serial.

Another modern battle story is "Woman, the Glory of the Nation," in which a number of good fighting scenes are shown. These were staged in Staten Island, across the bay from New York city, during May of last year. Three weeks were spent in preparing the ground, and one week in taking the actual scenes. Over one thousand soldiers of the Coast Defense Corps, N. Y. N. G., took part in the picture, under the direction of W. P. S. Earle and the supervision of J. Stuart Blackton.

In this Vitagraph production the wig-wag system was employed for directing the distant action, and the megaphone for close-up work. In order to keep people from wandering into the picture a system of telephones was installed to facilitate communication with the outpost guards. In all, six orders were issued before actual pictures were taken, which illustrates the complexity of a big battle scene.

The entire field was mined and the positions of the charges were indicated by inconspicuous stakes driven in the ground. The director, provided with a map of the mines, was in a position to issue orders for the electrical-firing of the various mines, giving the utmost realism to the charge of the troops through a curtain of fire.

"The Girl Philippa," another Vitagraph production, includes a number of fighting scenes of the house-to-house and street-fighting character in a Flanders village, between German and French troops. These scenes were staged in a village

Continued on page 459)

One of the concrete roads built by the New York State Highway Department, near Watertown. Burns Bros. and Haley, Watertown, Contractor. Edwin Duffey, State Highway Commissioner.

Avoid Waste in Road Building by Constructing Concrete Highways

THE demand for good roads in this country is widespread and insistent. Farmers are dependent upon them; motorists must have them, and the average city dweller who does not own a motor car is beginning to realize that the high cost of living is largely due to poor road transportation.

Millions have been appropriated for improving highways and millions are being spent annually. There is plenty of money in the country and plenty of willingness to spend it for a public need so vital. The problem now confronting the American people is *how* to plan, *how* to build and *how* to pay for its highways.

It is easy to waste money in temporary construction, in endless renewals and repairs, in roads which can not stand an enormously increased traffic.

Plan a System of Concrete Roads to Serve the Greatest Number of People

Build the system all at once so that you may enjoy the full benefit now. Pay for the roads with a bond issue spread over say twenty years, which an annual tax levy of a few cents per acre will liquidate.

Build them strong enough to stand future traffic. On improved roads traffic increases faster than population. This is true of railroads; it is equally true of highways. Traffic is drawn away from parallel routes.

Our highways are now being torn to pieces by a growing motor car traffic; but this is nothing to the punishment by heavy motor trucks which improved roads will have to stand. If the roads are not strong enough, they will have to be rebuilt in a few years at heavy expense to the community.

Main traveled highways should be built of concrete. It has the solidity and strength which make it the universal material for great engineering works.

Write for Bulletin No. 136 containing interesting facts about concrete roads. Then confer with your road officials.

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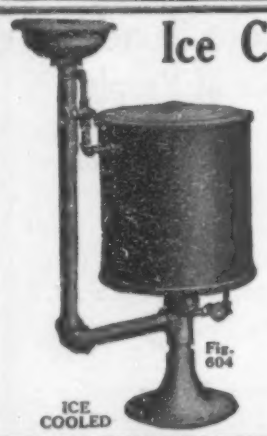

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Holds 75 Lbs. of Ice. *Supplies 150 Persons*

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Fig. 604

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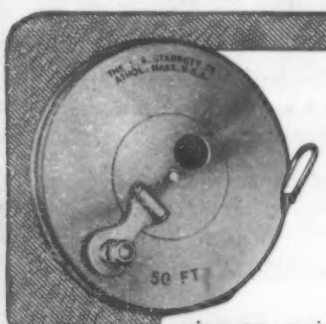

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especially suited for every measuring requirement. For fine measurements there are micrometers, vernier calipers, height gages, depth gages, etc. Other tools are steel tapes, rules, dividers, calipers, gages, etc.

Write for our free catalog No. 21 B describing 2,100 sizes and styles of these instruments.

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The World's Greatest Toolmakers

Foreign Commercial Notes and Queries

Manufacturers who are interested in the trade opportunities listed in this column, can obtain the names and addresses by complying with the following simple rules: 1. Write only one inquiry on a sheet. 2. Always give the serial number. 3. Write on your own business letterhead. The publisher of the SCIENTIFIC AMERICAN *assumes no responsibility as to the financial standing of concerns or individuals. Address all communications to the Query Editor of the* SCIENTIFIC AMERICAN, *Woolworth Building, New York.*

497.—A correspondent in Rangoon, Burma, desires to get in touch with leading boot and shoe manufacturers.

498.—A correspondent in France desires prices on small steam power plants, steel, farm implements, safety devices for the workshop, etc.

499.—A firm in Holland making dental goods is in the market for machinery for making dental apparatus and supplies of all kinds.

500.—A Chilean business man is in the market for machinery for making tin cans, metal buttons, padlocks and similar articles. He would also like catalogues of manufacturers of machines suitable for small industries. Correspondence should preferably be in Spanish.

501.—An Italian business man, who is now in the United States, desires to be placed in communication with American manufacturers and exporters of hardware, food choppers, coffee machines, kitchen utensils, liquid and powdered metal polishes and emery and emery paper. References.

502.—A man in France wishes to purchase machines for making fraternity badges, etc. Descriptive literature and price lists should be submitted. Quotations should be made f. o. b. New York. Payment will be made by cash against documents. Correspondence may be in English. Reference.

503.—A firm in Arabia is in the market for lanterns and enameled ware of all kinds and sizes. Quotations should be made c. i. f. destination. Payment will be made by 30 days' draft. Goods should be packed in large and strong packages. Correspondence may be in English. Reference.

504.—A company in Nicaragua, with offices in the United States, desires to purchase machinery to be used in the coconut industry and machinery for working cassava root.

505.—A man in France wishes to secure an agency for the sale of all kinds of agricultural machinery. Correspondence should be in French. Reference.

506.—A merchant in Russia desires to buy small plow tractors suitable for use in farming. He also wishes to entertain an agency proposition. Correspondence may be in English.

507.—A man in Spain desires to secure an agency for the sale of copper and brass sheets and tubes. Quotations should be made c. i. f. destination, if possible, otherwise f. o. b. New York. Payment will be made against shipping documents through local or New York bank. Correspondence may be in English. References.

508.—A man in Spain is desirous of securing an agency for the sale of aluminum, nickel, white metal, copper, brass and steel in bars. Quotations should be made c. i. f. destination, if possible, otherwise f. o. b. New York. Correspondence may be in English. References.

509.—A man in Spain desires to secure an agency for the sale of steel, brass and copper wire. Quotations should be made c. i. f. destination, if possible; otherwise, f. o. b. New York. Payment will be made against shipping documents through some local or New York bank. Correspondence may be in English. References.

510.—A commission merchant in Spain wishes to secure an agency for the sale of gas and gasoline motors and engines. If possible, quotations should be made c. i. f. destination, otherwise, f. o. b. New York. Payment will be made through some local or New York bank. Correspondence may be in English. References.

511.—A commission merchant in Spain desires to secure an agency for the sale of machinery for working iron and making tools. Quotations should be made c. i. f. destination, if possible, otherwise, f. o. b. New York. Payment will be made through some local or New York bank. Correspondence may be in English. References.

512.—A firm in Peru is in the market for medium-priced automobiles, rebuilt typewriters, wrapping paper, wall paper, crude-petroleum motors, furniture, canned goods, and hardware. It also desires to entertain an agency proposition. Quotations should be made f. o. b. American port. Cash will be paid. Correspondence may be in English. References.

513.—A company in South Africa desires to secure an exclusive agency for the sale of medium-priced knockdown motor boats, 16 to 20 feet long. Full information in regard to prices, discounts, etc., should be submitted. Quotations should be made f. o. b. New York. Payment will be made by cash against documents in New York. Boats should be packed in strong cases. Correspondence may be in English. Reference.

514.—A government official in South Africa desires to be placed in communication with American manufacturers and exporters of machinery for making vegetable-ivory buttons. Full information as to the process of manufacture should be submitted.

515.—A man in Italy wishes to secure an agency for the sale of supplies for lithographers, printers and bookbinders, including metal thread, paper and ink. Quotations should be made f. o. b. shipping port. Correspondence should be in Italian or French. References.

516.—A company in China desires to be put in touch with American manufacturers and exporters of round-head brass paper fasteners. Quotations should be made c. i. f. destination or f. o. b. American port. Payment will be made by sight draft attached to documents through local bank.

517.—A firm in Colombia is in the market for sawmill and woodworking machinery, sawdust blowers and smoke consumers. Quotations should be made f. o. b. New York or c. i. f. Puerto. Payment will be made by 90 days' sight draft. References. Correspondence should be in Spanish.

518.—A newspaper establishment in Bolivia desires to receive catalogues and quotations from American manufacturers and exporters of complete machinery for a photo-engraving and stereotyping plant; machines to be equipped with individual motors. Correspondence should be in Spanish.

519.—A man in England desires to secure an agency for the sale of agricultural machinery and appliances. Credit terms are desired. Reference.

520.—A man in Mexico wishes to represent American manufacturers and exporters of iron fittings for doors, windows, etc., such as hinges, bolts, latchkeys, etc.

521.—A company in China desires to purchase mechanical water filters. Quotations should be made f. o. b. American port or c. i. f. destination. Correspondence may be in English.

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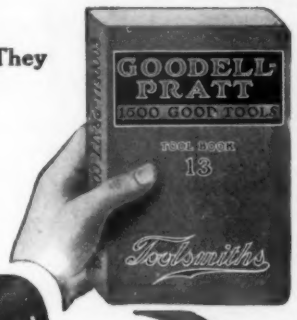

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And because Boston Garters do their important work unseen, don't let them be the last things you think of. Follow your natural impulse and keep them fresh and lively. The added comfort repays you.
Take home a new pair today
Boston Garter
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Sold Everywhere. 25 cts., 35 cts., 50 cts.
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Generals of Shadowland Warfare

(*Continued from page 457*)

erected for the purpose near Sheepshead Bay, Brooklyn, N. Y. Because of the proximity of the players to the director, the megaphone method was used almost exclusively by the director, S. Rankin Drew. Among the startling scenes of this picture is the shelling of a cabaret room which is being employed as a hospital. In producing this scene, explosives were placed at various points in the walls and electrically fired at the propitious time to simulate shell explosions.

A Village on a Clockwork Basis

Director James Kirkwood recently achieved a signal success in a New England village scene which he was directing for a Mutual photoplay. The street of the village was built especially for him on the grounds of the studio, and the whole village with its various side streets and residential districts, was more than a quarter of a mile long. At the extreme end of the main street was placed a specially constructed camera platform, built so that the director might raise his camera to any height desired.

In the scene he obtained were seen the usual little groups of village loiterers. At one spot two men were "pitchin' horseshoes;" at another, the itinerant peddler was selling his wares in back of a wagon; at still another, the village drunkard was haranguing the usual crowd of village loafers. At the end of the street, farthest from the camera, a wagon loaded with hay swung into vision and passed into the end of the street. When it reached a certain cross street, a throng of children ran laughing and playing into view. It was evident that "school was out." The youngsters swarmed over the hay wagon, while some of them climbed on top for a free ride.

To have all these bits of "atmosphere" coördinated required careful preparation, especially as the difficulties of rehearsing each group into its work were very great. From his vantage point on the camera platform, Kirkwood commanded a clear view of all the action. Masked by buildings and doorways, six assistants under the charge of Kirkwood's lieutenant, Arthur Howard, each started his own group of actors into its particular business. At the foot of the camera platform, and to the right, was a telephone switchboard temporarily placed so that Kirkwood could call out his instructions to the operator, who relayed them to each assistant over field wires. In the film the line of wiring which stretches down the main street served a dual purpose, for it added to the realism of the scene and in reality carried the telephone lines through which the director kept in touch with his assistants. The whole, as is usually the case with the big mob scenes, takes but a few minutes on the film, but its effect was well worth the hours of preparation which had been made on it.

When the Public Acts for the Pictures—and Without Knowing It

Just one instance will serve to demonstrate how a director sometimes secures a splendid mob picture without letting the involuntary actors know that they are being filmed. A director was recently confronted with the difficult problem of securing a scene in which many persons crowd about several newsboys who are announcing an important "extra." According to the film story, the "extra" tells of the election of one of the candidates, to the displeasure of everyone.

After considerable thought the director decided on a somewhat unusual scheme, although others of a similar nature are resorted to by different directors. He had several boys don the garb of newsboys and sent them out on the boardwalk at Venice, California. Meantime the cameraman and director concealed themselves in a nearby building, within full view of the pseudo newsboys. The large crowds at the resort were soon startled by the cry of the boys to the effect that England had declared war on the United States. Everybody rushed up for a copy of the newspaper,

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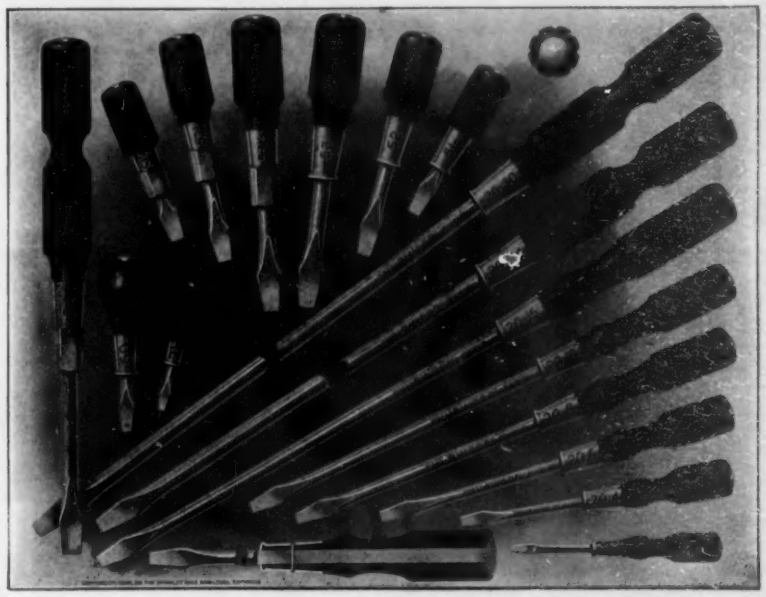

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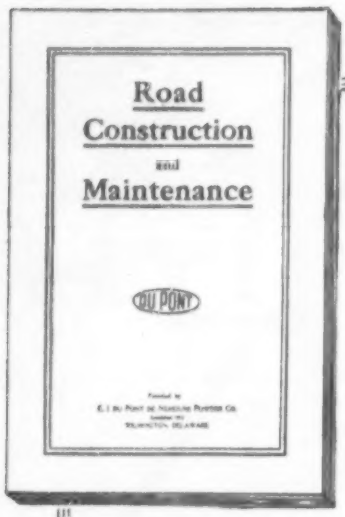

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BLOWING A TRENCH—From Leslie's

The *best* war-pictures,

the *most* war-pictures—

—*first* in

Leslie's
Illustrated Weekly Newspaper
Established in 1855

Every week
—ten cents
—at every news stand

and upon purchasing a copy stood about endeavoring to find the item regarding the declaration of war. Obviously, these people became more and more angry at not finding what they were after, while the camera recorded every evidence of surprise, followed by chagrin. It only remained for the cameraman, director and newsboys to escape the angry crowd, which they successfully accomplished amidst the excitement which reigned.

Such is the work of the generals of shadowland warfare—the directors of photoplays. Hundreds of instances might be cited if space permitted, but the foregoing will serve to give a general idea of the director's work. One moment finds him directing a highly emotional actress in a close-up scene where the stage is measured in feet, another moment he is directing a thousand or more untrained, unemotional extra people in a stage five miles deep. In the first instance he must handle his subject with consummate skill in order to bring out the foremost characteristics of the player yet avoid over-acting, while in the second he must secure plenty of action and enthusiasm by every method in his power. In either case he is the artist, and he sketches and paints with his cast and his lighting equipment and his cameras and his backgrounds.

Use of State Convicts for Road Building Increasing

A STEADY decrease since 1885 in the proportion of convicts in the United States employed in miscellaneous work under lease and contract and a marked increase in the proportion employed for the benefit of the State on highways and other public works are shown in statistics just published by the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture. The systems of convict labor are classified as lease, contract and piece-price systems, under which the labor of the convicts is for the benefit of private individuals or corporations, often in the manufacture of commodities; the public-account system, under which the convict-made goods are sold by the State; the State-use system, under which goods are manufactured only for use in State institutions; and the public works and ways system, under which the labor of the convicts is devoted to public structure and roads.

The latter system has grown in popularity, it is pointed out, because it makes use of the convict labor with a minimum of competition with free labor, contributes fairly lasting benefits to the whole community, affords healthful and even somewhat reformative employment to the convicts, and reduces congestion in penal institutions. The most satisfactory use of the system, in the opinion of the Department's road specialists, is under State rather than county administration. Since 1885, the report shows, the percentage of convicts in a large number of representative institutions working under the public-account, State-use, and public works and ways systems, has increased from 33 to 86 per cent. while the proportion engaged in road work alone has increased from 1.3 per cent to nearly 13 per cent.

Convicts should not be indiscriminately put to work on roads, it is pointed out. Only those who are physically fit for the work should be employed. It may be even desirable and practicable in many instances to reserve assignment to the open-air work as a reward for good behavior, Physically and by former mode of life, statistics cited in the report show, about three-fourths of the average male prison population is better fitted for outdoor labor than for shop work. In practice, when all considerations are taken into account, it has been found that from 25 to 50 per cent of the male inmates of prisons are available for road work.

The employment of State convicts in road making, the report shows, first became general in the south in the early nineties. Such use of State convicts has been made by northern and western states, however, mostly during the last ten years.

Two Billion Paving Bricks a Year

AT the annual meeting of the American Ceramic Society held March 5th-8th, in New York, Mr. J. B. Shaw of Alfred, N. Y., told of some very successful tests he had made in making paving brick from blast furnace slag. These bricks were worth about $35 per thousand in 1915. They may be successfully made of almost any blast furnace slag at a cost of five to seven dollars per thousand. He figures that there is at present available about 16,000,000 tons of slag annually in the United States after leaving 2,000,000 tons for cement manufacture. This would provide the two thousand million bricks for permanent good roads every year—say for 1,000 miles annually of 50-foot road.

Time and again failure has been encountered in the effort to make paving brick in this manner, but the problem seems to be fairly well worked out now. The slag must be treated hot as it comes from the furnace and the brick must be heated out of contact with air of steam lest it become brittle.

Trucks in Building Construction

INGENIOUS contractors who have found the motor truck a great value in economical transportation of building materials have learned that its usefulness is not limited to work on the street level. In building factory structures of the latest reenforced concrete type it is desirable to move materials to the upper floors of the building as the work progresses. It is possible, where space is available, to build inclines or ramps, by which the heavy motor truck can take its load up to an upper story as well as to the ground level. This makes it possible for the contractor to deliver the materials of construction right where they are needed. This arrangement is susceptible to many variations and can be used just as well in wrecking structures as in building them. It is stated that the cost of building a ramp is more than compensated for by the saving made possible in transportation. Without an incline of this kind all loads must be delivered at the ground level and materials to be used on the upper floors must be hoisted by the temporary and small capacity contractor's elevator.

An Armadillo Farm Devoted to the Making of Armadillo Baskets

THE distinction of being the only armadillo farm in the world belongs to the enterprise of Charles Apelt of Texas. His business consists of capturing the little animal of the border country and converting it into the armadillo basket, which is known in many lands for its unique attractiveness.

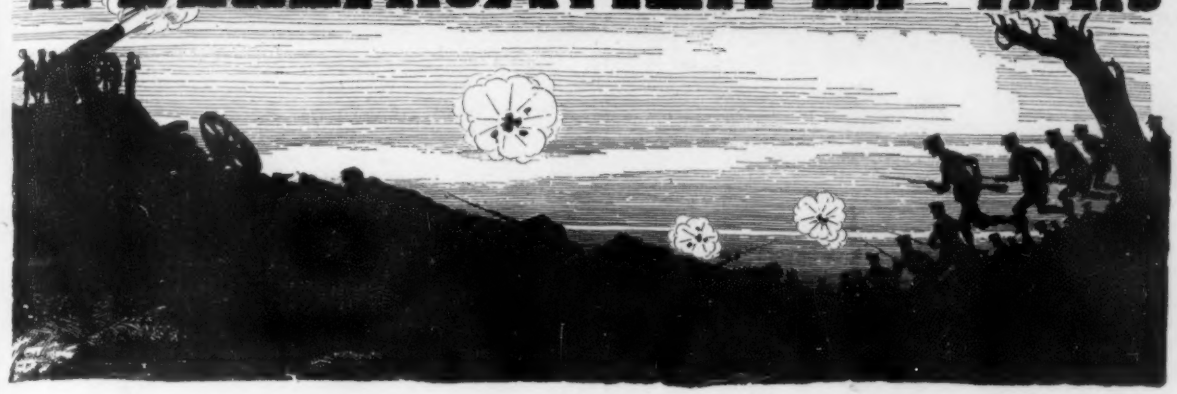
The armadillo is usually caught at night, the hunt being carried on with hand lanterns. It is then killed and the body or meat cut from the shell, after which the shells are laid out to dry. The head and tail are then tied together and form the handle for the basket. The shells are now varnished and the interior trimmed with fancy goods, making a basket that is at once ornamental and most useful.

Mental Effects of Smoking

IN these days, when prohibition fanaticism has begun a determined onslaught upon the use of tobacco, lovers of the "weed" will be glad to learn that some tests recently made by Prof. C. S. Berry, are, as far as they go, favorable to the thesis that smoking materially facilitates mathematical work.

The experimenter, who reports his experiments in the Psychological Bulletin, added columns of figures each evening, half an hour after dinner. On alternate evenings he smoked a cigar immediately before preforming the test, and he kept a record of the speed and accuracy of his work. While there was little difference in accuracy, the total number of errors being negligible, his speed was 7.7 per cent better on "smoking" days. It is to be hoped that other and more elaborate investigations will be undertaken upon this timely subject.

A DECLARATION OF WAR



Has forced us to a keen realization of the need for proper preparedness. The safety of America's industrial bulwarks — her big manufacturing plants — must be assured.

One of the first precautions taken at plants whose output at this critical time, is required by the U. S. Government, is the erection of factory fencing that really protects.

Cyclone Property Protection Fencing

Our engineers will advise with you as to the kind and style of fence best suited to your needs.

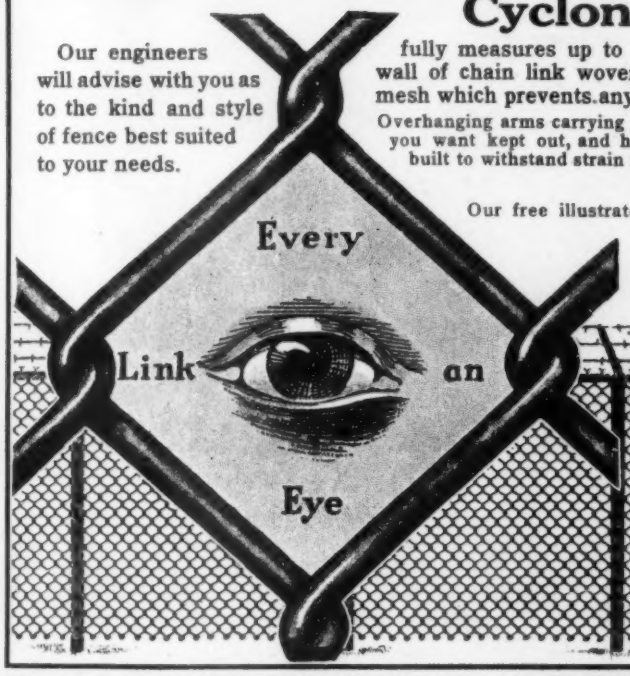
fully measures up to war-time requirements. It presents to the would-be intruder a non-climbable wall of chain link woven steel. Fabric made of best quality, heavily galvanized wire, woven into small mesh which prevents any marauder gaining a toe-hold.

Overhanging arms carrying barbed wires keep out those you want kept out, and heavy tubular steel posts are built to withstand strain from all sides.

Cyclone Property Protection Fence reduces risk of fire and losses. It cuts the cost of watchmen to a mere fraction and pays for itself thru these savings.

Fence that costs less per foot, costs more per year.

Our free illustrated catalog is one of the worth while books we shall be pleased to send you on request.



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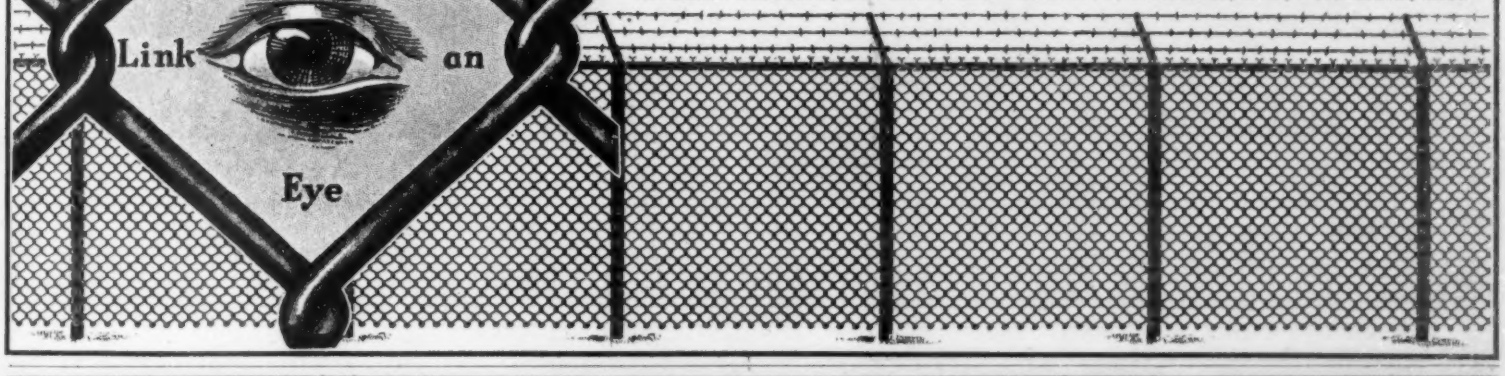


The 'Royal Cord' Tire

There's a very big reason why the *'Royal Cord' Tire is the "Monarch of All Cord Tires":*

—the *'Royal Cord'* is the tire of supreme resiliency and elasticity;

—the *'Royal Cord'* is the tire of rugged endurance and toughness;

—the *'Royal Cord'* is the tire of masterful anti-skid service and amazing long mileage;

—the *'Royal Cord'* is the tire of beauty and distinction.

Other motorists have tried the *'Royal Cord'* and know this reason.

Try *'Royal Cords'* and learn how good a cord tire *can* be.

The 'Royal Cord' Tire is one of the five United States Tires that are making such phenomenal sale increases.

United States Tires

Troy Trailer in operation by
Jacob Ruppert Brewery, New York (Mercedes Truck)

Getting the Most out of Your Truck

Any good 3-ton truck has the structural strength to CARRY 3 tons, and perhaps slightly more than that. But, that same 3-ton truck has power to HAUL not only its 3-ton load, but, also PULL as much again in addition to the load it is carrying. And, under ideal conditions, up to several times as much more. Many truck users don't know this. They think the capacity of their truck is only what they can pile on it. But *other* truck users — hundreds of them—have quit limiting the load to what they can actually pile on, and have started PULLING. They are utilizing the power they had previously wasted. Now, instead of buying more trucks with motors in them, they are buying motorless trucks—

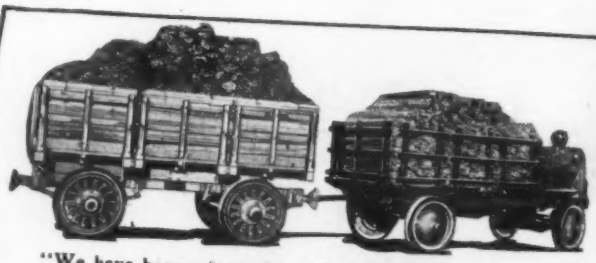
"Troy Trailers"

—and letting their motor truck do all the work it has the capacity for doing.

They find that where a 5-ton truck costs $16.00 a day to operate (on a 50-mile basis), they can attach a 5-ton Troy Trailer, and operate it on the same schedule for only $3.92 a day.

Certainly some saving.

This is the reason that the biggest concerns in the country—the concerns that figure hauling down just as close as they figure buying merchandise, are the biggest users of Troy Trailers.



"We have been using a 5-ton Troy Trailer with a 3½-ton G. M. C. truck and are handling from seven to nine tons a trip with this outfit, and find it very cheap way to reduce the cost of freight handling." **Saxon Motor Co., Detroit**

"We cart about 80% more than what we did without the Troy Trailer"
"The material we cart is Cast Iron Pipe and fittings, most of our trucking is done to New York and Brooklyn, involving several stops."
Essex Foundry, Newark, N. J.

Troy Wagon Works Co.
Troy, Ohio

Branches or Distributors in all principal cities

How to Figure What Your Truck Can Do

Troy Wagon Works Co.
Troy, Ohio

Kindly mail me booklet — "How to Figure What Your Truck Can Do."

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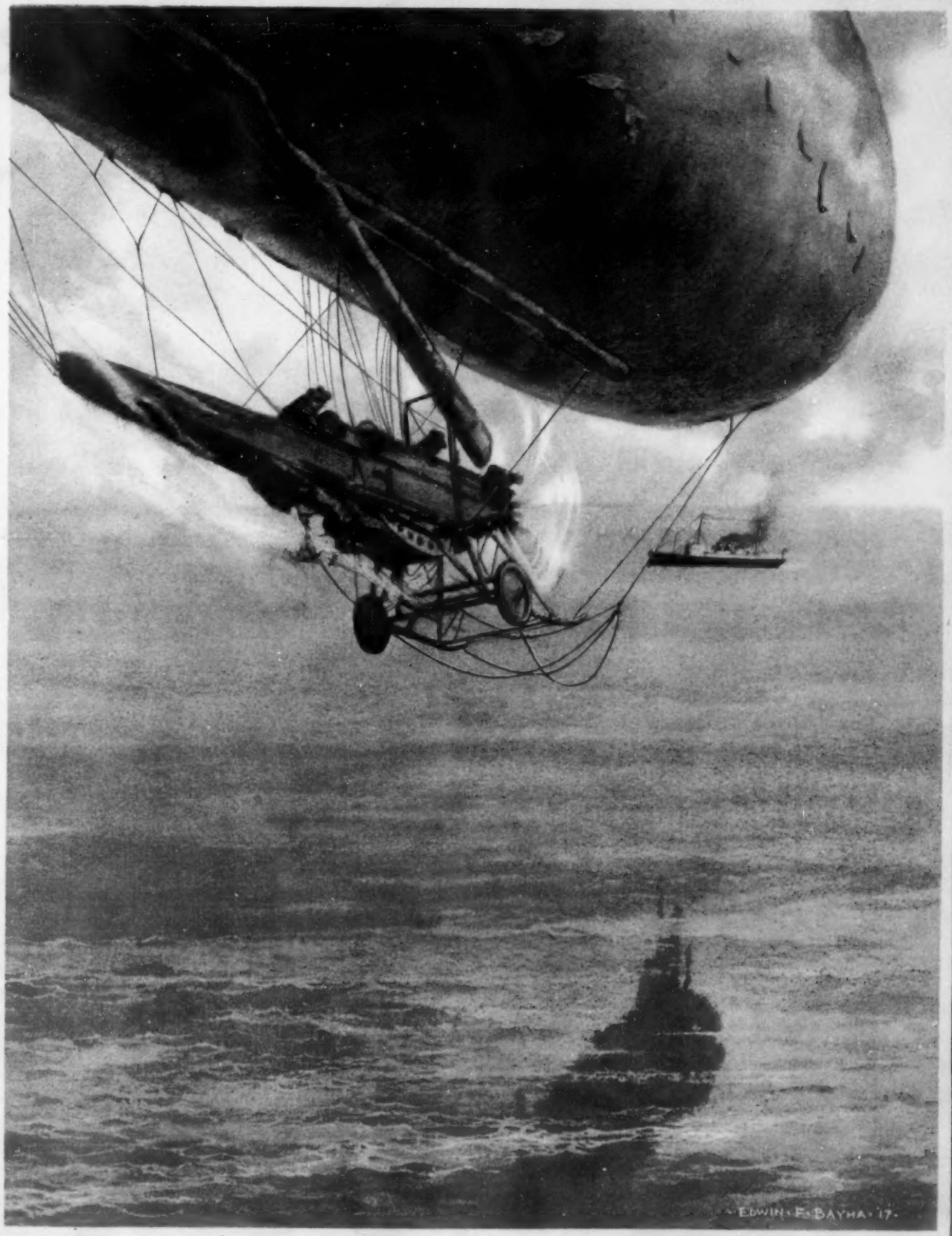

HUNTING FOR ENEMY SUBMARINES WITH A SMALL SCOUT-DIRIGIBLE—[See page 470]

May 12, 1917

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

Outside Nikko Inn—Harmon, N. Y.

The Practical Tire That Is the Luxury Tire

GOODYEAR Cord Tires are eminently practical tires—for every penny of extra first-cost there is returned to you an added value in tire-virtue and tire-usefulness.

The greater mileages they deliver, the positive savings they effect in fuel and engine-effort, their longer life and stouter endurance, the protection their greater cushioning power affords your car — these combine to make them the most economical tires to own.

Any motorist can buy Goodyear Cords strictly on this basis and safely expect from them entire satisfaction.

But Goodyear Cord Tires are luxury tires as well—built to outrank the ordinary tire in quality as in worth, to confer added distinction upon the finest motor car, to serve more ably in all ways that a tire may serve.

They add to the riding-comfort of any car. They add to the speed of any car. They add to the security of any car. They add to the enjoyment of any car.

That quick and athletic resilience which lengthens gasoline mileage and increases car-speed defends them from stone-bruise and similar injury, protects them and the travelers they carry from road-shock and vibration, smooths all roads.

That largeness of girth and thickness of tread which insure long life and astonishing mileage, afford immense security; and freedom from trouble, delay and inconvenience as well.

Wherever you may be or may go, over whatever roads or under whatever conditions, your car shod with Goodyear Cord Tires travels with greater ease, sureness and spirit than is otherwise possible.

The advantages of Goodyear Cords are very real. They need not be conjectured or guessed at —they *are*. Some you will appreciate in the first block of travel; it will take a season to learn them all.

Goodyear Cords are by every reason of thrift and pleasure, the tires for you. Their quality makes them higher-priced—and *better*.

Goodyear Tires, Heavy Tourist Tubes and "Tire Saver" Accessories are easy to get from Goodyear Service Station Dealers everywhere.

The Goodyear Tire & Rubber Co.
Akron, Ohio

GOODYEAR
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CORD TIRES